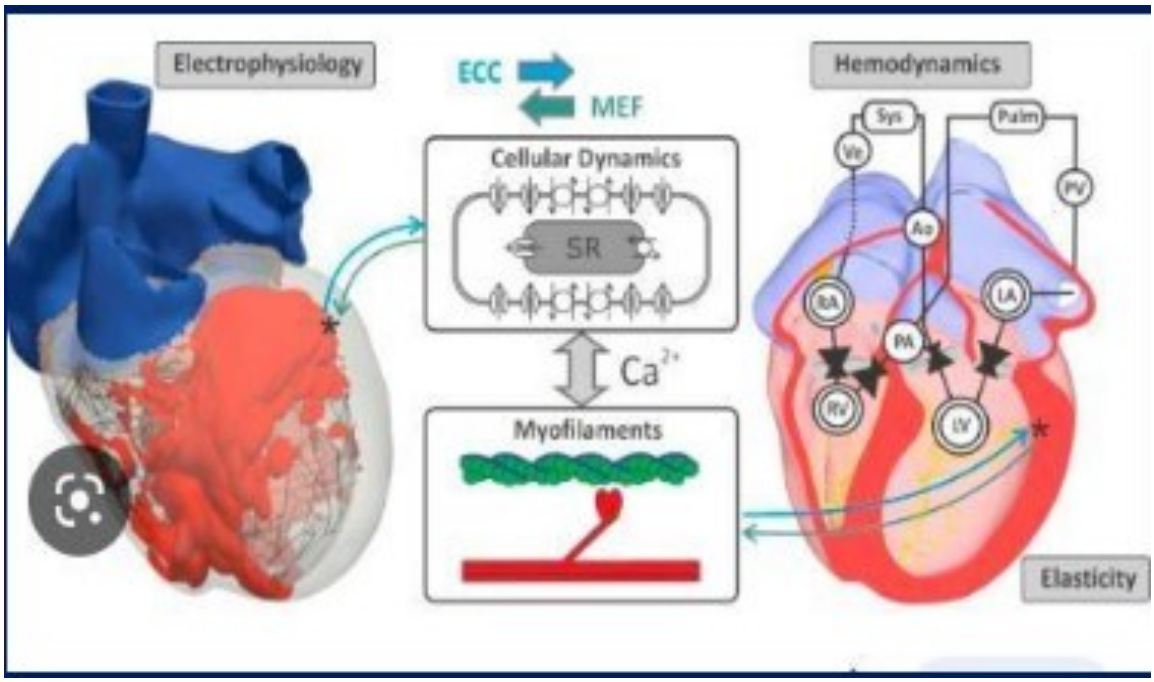
On the Eve of our President's Birthday : 30 June 2023

Modelling of Physiological Systems



Compiled by:
Editorial Board

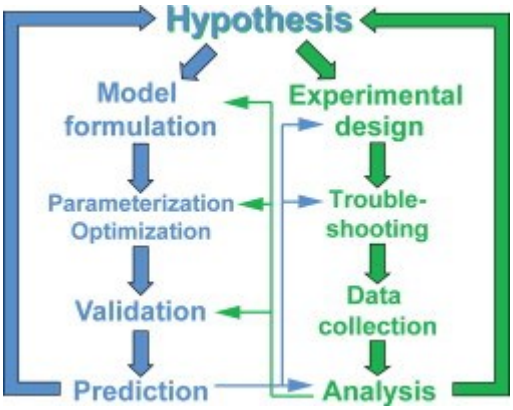
Department of Biomedical Engineering

Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

Modelling of Physiological Systems

Compiled by:

Editorial Board



Department of Biomedical Engineering

Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

Modelling of Physiological Systems

All rights are reserved. No part of the publication may be reproduced, stored in a retrieval system (including but not limited to computers, disks, external drives, electronic or digital devices, e-readers, websites), or transmitted in any form or by any means (including but not limited to cyclostyling, photocopying, docutech of other reprographic reproductions, mechanical, recording, electronic, digital versions) without the prior written permission of the publisher, not be otherwise circulated in any form of binding or cover other than that in which it is published and without a similar condition being imposed on the subsequent purchaser.

June 2023

Published by:

Department of Biomedical Engineering
Dr MGR Educational and Research Institute
[Deemed to be University]
Maduravoyal, Chennai - 600 095

Funded by:

Na Subbu Reddiar 100 Educational Trust
AD-13, 5th Street, Anna Nagar West, Chennai—600 040

978-93-95054-58-4

ISBN 978-93-95054-58-4

9 789395 054584

Printed at:
DJ Printers, Chennai – 600 095

Editorial Board
Editors
Ms. B. Rengammal Sankari Assistant Professor, EEE Department Dr. MGR Educational and Research Institute
Ms S. Saranya Assistant Professor BME Department Dr. MGR Educational and Research Institute
Editors-in-Chief
Dr. K. Sujatha Professor, EEE Department Dr. MGR Educational and Research Institute
Dr T. Kalpatha Reddy Professor ECE Department Dr. MGR Educational and Research Institute
Co-Editor
R.S. Srivardhini IIyr BME Department Dr. MGR Educational and Research Institute
Contributors
49 Students of Second Year [Batch 2021-2025] **BME Department**

TABLE OF CONTENTS

S.NO	TOPIC	AUTHORS WITH AFFLIATION	PAGE NO
UNIT - 1 APPROACHES TO MODELING			
1.1	LINEAR AND NON LINEARSYSTEM	DEEBA.A.R	1
1.2	PREY PREDATOR MODEL	AMSITH.S	3
1.3	LUMPED PARAMETERSMODEL	ANANDHAKUMAR.T	5
1.4	CLASSIFICATION OF MATHEMATICAL MODELLING	DEEPALAKSHMI.D	8
1.5	PURPOSE OF PHYSIOLOGICALMODELLING AND SIGNAL ANALYSIS	GOURY NANDANA.K.S	10
1.6	TYPES OF MODELS	JAYASHREE.N.R	12
1.7	PRINCIPLES OFFORMULATION	AFREEN.J	14
1.8	USES OF MATHEMATICALMODEL	MENAKA.G	16
1.9	TECHNIQUES OF MATHEMATICAL MODELLING	PRIYANKA.H	18
1.10	MATHEMATICAL MODELS	SIMRAN.M	20
1.11	INTRODUCTION OF MATHEMATICAL MODELLING	UDHAYAKUMAR.P	22
1.12	TIME VARIANT ANDTIME INVARIANT SYSTEM	YAMUNASRI.S	24
UNIT - 2 NONPARAMETRIC AND PARMETRIC MODELING			
2.1	PARAMETRIC MODELS	RESHMA.K	26
2.2	BASIC PARAMETRIC MODELFORMS AND ESTIMATION PROCEDURES	MINISHA.S	28
2.3	VOLTERRA KERNELS MEASUREMENTS TO PARAMETRIC MODELS	DIVYASRI.S	30
2.4	BASIC PARAMETRIC MODELFORMS AND ESTIMATION PROCEDURES	HEMA.R.G.S	32
2.5	DISCRETE TIME VOLTERRA KERNEL OF NARMAX MODELS	JANANI.B	34
2.6	PARAMETRIC AND NON PARAMETRIC EQUIVALENCE BETWEEN CONTINOUS AND DISCRETE	JAYAPRAKASH.E	36
2.7	MATHEMATICAL MODEL OFLOTKA VOLTERRA	BALAJI.S	38
2.8	LOTKA VOLTERRA	VALARMATHI.S	40
2.9	PREDICTION ERROR METHOD	LAVANYA.K	42
2.10	PARAMETRIC AND NON PARAMETRIC ESTIMATION ERRORS	MONIKA.S	44
2.11	WIENER MODELS	VASANTH.K	46

UNIT - 3 EQUIVALENT CIRCUIT MODEL			
3.1	HODGKIN HUXLEY MODEL	THIRUPURASUNDARI.E	48
3.2	RESISTIVITY AND CAPACITIVE PROPERTIES OF CELL MEMBRANE	GAYATHRI.S	50
3.3	HODGKIN HUXLEY MODEL	GUNAL.N	52
3.4	HODGKIN HUXLEY MODEL	JANARDHANAN.D	54
3.5	MODELLING OF EMG	MELVIN SILVESTER.L	56
3.6	ELECTRICAL RESPONSE OFTHE CELL MEMBRANE	DHARSHINI.M	58
3.7	ELECTRICAL RESPONSE TOINJECTED CURRENT	SELIN CHRISTY.M	60
3.8	AMPLITUDE MEASUREMENTS	SELVA.R	62
3.9	HODGKIN HUXLEY MODEL	SATHISHKUMAR.J	64
3.10	HODGKIN HUXLEY MODEL	SRIVARDHINI.R.S	66
3.11	CIRCUIT MODEL	SUPRAJHAA.M	68
UNIT - 4 PHYSIOLOGICAL MODELING – I			
4.1	MODEL OF HENLES LOOP	ABISHEKKANNAN.M	70
4.2	COUNTER CURRENT MODELOF URINE FORMATION	DEVADHARSHINI.V	72
4.3	GERM AND PLASMA CELL	RIDHAFATHIMA.M	74
4.4	LINEARIZED MODEL OFIMMUNE RESPONSE	VINODITA.N.R	76
4.5	ANTIBODY	MOHAMMED AKRAM.M	78
4.6	ELECTRICAL ANALOG OFBLOOD VESSELS	VASUNDARA.S	80
4.7	TRANSFER SOLUTES BETWEEN PHYSIOLOGICAL COMPARTMENTS BY FLUID FLOW	RIZWANA BEGUM.K	82
4.8	SYSTEM EQUATION ANDSTABILITY CRITERIA	PRAVEENKUMAR.S	84
4.9	MODEL OF CORONARYCIRCULATION	SNEKAA.M	86
4.10	MODEL OF SYSTEMATICBLOOD FLOW	SWETHA.J	88

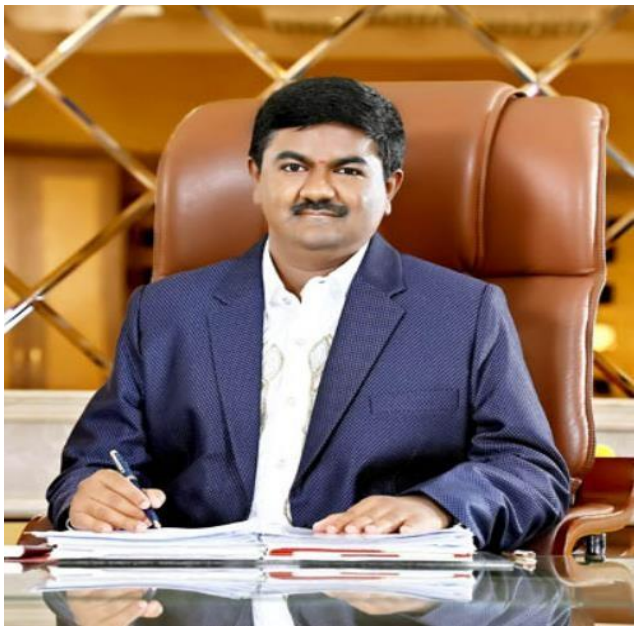
UNIT - 5 PHYSIOLOGICAL MODELING – II			
5.1	ENGINEERING MODELLING OF HUMAN CARDIOVASCULAR SYSTEM	DEENATHAYALAN.A	90
5.2	EQUIVALENT CIRCUITS /MIMO SYSTEMS	JOHN ARTHUR.A	92
5.3	OXYGEN GLUCOSEMONITORING	KRISHNA RAJ.R	94
5.4	HUMAN IMMUNE SYSTEM	KARTHICKEYAN.V	96
5.5	SPATIOTEMPORALMODELLING	PAUL EPHRAIM.D	98

PREFACE

Physiological modelling defines the development of mathematical models that replicate the multi-physics. This book contains various multiple choice questions pertaining to physiological modelling of systems prepared by many authors from II year Students of Biomedical Engineering Department, Dr. MGR Educational and Research Institute, Chennai, India. Objective type questions with correct answers for some important topics are covered in this book for the subject, physiological modelling of human systems and will be useful to clear various competitive examinations.

The topics covered in five units of the prescribed syllabus, includes, approaches to modelling, non-parametric and parametric modelling, equivalent circuit model for circulatory and respiratory systems for various physiological modelling like Hodgkin Huxley model, model of Henle's loop, Wind hussel model. It is a great pleasure for us to thank all those valuable suggestions that have been given to me by Dr. K. Sujatha, Professor, EEE/BME Department, to publish this book. At this juncture, we also thank the HoD/EEE, Dr. K. Saravanan, all the other faculty members and non-teaching staff for supporting us. We also extend our heartfelt thanks to our beloved President, Er. A.C.S. Arunkumar, Registrars, Additional Registrars, Joint Registrars, Deans, HoD of various departments and all the other higher authorities who have directly or indirectly supported us for completing this book.

PRESIDENT MESSAGE



It is truly hearting to note that the Department of Biomedical Engineering has come out with an innovative titled, "Modeling of physiological systems". This book is especially written by 2nd Year BME Students for competitive examiners. It gives the basic Ideas about different types of Mathematical modeling in physiological systems. I earnestly congratulate the efforts taken up by each and every one for making such a magnanimous work possible in a short duration. I wish the staff members and students good luck and wish them to carry on more successful expeditions like this in future.

Er.A.C.S. ARUNKUMAR,

President,

Dr. M.G.R Educational and Research Institute.

DEAN MESSAGE

Multiple-choice tests are used to assess the various levels of learning outcomes. Since the multiple-choice type of questions focuses on a relatively broad representation of course materials, it increases the validity of assessment. Also, in various competitive examinations for higher studies and the industrial recruitments, the objective type multiple-choice questions are asked. I am very much glad to appreciate the second year students of Biomedical Engineering and their mentor Dr.K.Sujatha for compiling the multiple choice questions and answers book for the Modelling of Physiological Systems course. I sincerely hope that this book helps the students to practice and enable them to succeed the competitive examinations with confidence.

Dr.N.Ethiraj

Dean (Engg. & Tech.)

Dr. M.G.R Educational and Research Institute

UNIT - 1 APPROACHES TO MODELING

1.1 LINEAR AND NON LINEARSYSTEM

DEEBA A R
211241101006

1.A system is linear if and only if it satisfies

A. Principle of additivity
B. Principle of homogeneity
C. Both (A) and (B) above
D. Neither (A) nor (B) above

ANSWER: C. Both (A) and (B) above

2.In a non-linear control system, limit cycle is self-sustained oscillation of

A. Variable amplitude
B. Variable frequency
C. Fixed frequency
D. Fixed frequency and amplitude

ANSWER: D. Fixed frequency and amplitude

3.Practically all the elements are

A. Linear
B. Non-linear
C. Exponential
D. None of the above

ANSWER: B. Non-linear

4.The need of assuming non-linear element as linear

A. Simplicity of analysis and accuracy of results
B. Ease of calculations
C. Less time consuming
D. Mathematical tool available

ANSWER: D. Mathematical tool available

5.System non-linearities are taken account by

A. Analytical
B. Graphical and numerical techniques
C. Both (A) and (B)
D. None of the above

ANSWER: C. Both (A) and (B)

6.The superposition theorem is

A. Homogeneity
B. Additivity
C. Combination of homogeneity and additivity
D. Applied to non-linear systems

ANSWER: C. Combination of homogeneity and additivity

7.The standard test signal can be applied to give output to

A. Linear systems
B. Non-linear systems
C. Time variant systems
D. Time invariant systems

ANSWER: A. Linear systems

8.In non-linear system stability is

A. Dependent on the input
B. Independent on initial state
C. Independent on input
D. Dependent on input and initial state

ANSWER: D. Dependent on input and initial state

9.Linear mathematical model applies to

A. Linear systems
B. Stable systems
C. Unstable systems
D. All the above

ANSWER: B. Stable systems

10. Determine the nature of the system: $y(t) = t^2 x(t-1)$

A. Linear, time invariant
B. Linear, time variant
C. Non-linear, time invariant
D. Non-linear, time variant

ANSWER: B. Linear, time variant

1.2 PREY-PREDATOR MODEL

AMSITH S
211241101003

1. Prey-predator model is known as ____

   A. Lotka-Volterra model
   B. Static model
   C. Dynamic model
   D. Numerical model

ANSWER: A. Lotka-Volterra model

2. Prey-predator model was developed by_____

   A. J. J. Thomson and Archimedes
   B. Ernest and Louis
   C. Alfred J. Lotka and Vito Volterra
   D. Galileo and Michael

ANSWER: C. Alfred J. Lotka and Vito Volterra

3. Prey-predator was developed in the year____ A. 1987
   B. 1970
   C. 1939
   D. 1920

ANSWER: D. 1920

4. The population will grow exponentially when predator is_____

   A. Present
   B. Absent
   C. None of the above
   D. Both A and BANSWER: B. Absent

5. Predator can consume _____

   A. Infinite number of prey
   B. Finite number of prey
   C. Constant number of prey
   D. Few number of prey ANSWER: A. Infinite number of prey

6. The prey population will go extinct, when the predator population size is_____
   A. Small
   B. Few
   C. Large
   D. Medium

ANSWER: C. Large

7. The prey population size increases, when the predator population is_____

A. Large
B. Small
C. Few
D. Two

ANSWER: B. Small

8. Prey equilibrium is determined by_____

A. Prey population size
B. Predator population size
C. Prey-predator population size
D. None of the above

ANSWER: B. Predator population size

9. Predator equilibrium is determined by_____

A. Prey population size
B. Prey-predator population size
C. Predator population size
D. None of the above

ANSWER: A. Prey population size

10. Prey-predator model predicts_____

A. Predator population
B. Prey population
C. Cyclical relationship between predator and prey
D. None of the above

ANSWER: C. Cyclical relationship between predator and prey

1.3 **LUMPED PARAMETERS MODEL**

ANANDHA KUMAR T
211241101004

1. What will be the characteristic length for a sphere?

   A. R/2
   B. R/6
   C. R/4
   D. R/3

ANSWER: D. R/3

2. A hot steel sphere of diameter 40mm is immersed in oil. If the heat transfer coefficient between the sphere and oil is 300 W/m2K, then Biot Number is [Take K steel = 50 W/mK and Koil = 0.2 W/mK]

   A. 0.04
   B. 0.12
   C. 0.12
   D. 0.24

ANSWER: A. 0.04

3. A beaker filled with hot water in a room cools from 70°C to 65°C in t1 minutes, 65°C to 60°C in t2 minutes and from 60°C to 55°C in t3 minutes, then

   A. $t1 > t2 > t3$
   B. $t1 = t2 = t3$
   C. $t1 < t2 < t3$
   D. Cannot be concluded

ANSWER: C. $t1 < t2 < t3$

4. A sphere, a cube and a disc all of the same material, quality and volume are heated to 900 K and left in air. Which of these have the lowest rate of cooling

   A. Cube
   B. Disc
   C. Sphere
   D. All will have the same rate of cooling

ANSWER: C. Sphere

5. Heat flow in unsteady-state heat conduction may be expressed in terms of which of the following two dimensionless numbers?

   A. Nusselt and Fourier numbers
   B. Prandtl and Schmidt numbers
   C. Grashof and Graetz numbers
   D. Biot and Fourier numbers

ANSWER: D. Biot and Fourier numbers

6. A body cools from 90°C to 80°C in 5 minutes. Under the same external conditions to cool from 80°C to 70°C the body will take

   A. 5 minutes
   B. 4 minutes
   C. 2.5 minutes
   D. More than 5 minutes

ANSWER: D. More than 5 minutes

7. A solid copper ball of mass 500 gm when quenched in a water bath at 30°C, cools from 530°C to 430°C in 10 sec. What will be the temperature of the ball after the next 10 seconds?

   A. 300°C
   B. 320°C
   C. 350°C
   D. Cannot be determine

ANSWER: C. 350°C

8. The dimensionless numbers used for analyzing the transient heat conduction problems in a plane wall, cylinder, and sphere is

   A. Nusselt number and Fourier number
   B. Reynolds number and biot number
   C. Biot number and Fourier number
   D. Nusselt number and biot number

ANSWER: C. Biot number and Fourier number

9. The time is required by a thermocouple to reach its 63.2 per cent of the value of initial temperature difference is called its

   A. Thermocouple junction
   B. Sensitivity
   C. Change in temperature
   D. Response of thermocouple

ANSWER: B. Sensitivity

10. Lumped system analysis assumes a uniform temperature distribution throughout the body, which will be the case of the body to heat conduction is

    A. 3
    B. 2
    C. 1
    D. 0

ANSWER: D. 0

1.4 CLASSIFICATION OF MATHEMATICAL MODELLING

DEEPALAKSHMI. D

211241101008

1. The structural models are also known as

   A. Empirical model
   B. Theoretical model
   C. Gray box model
   D. Black box model

ANSWER: B. Theoretical model

2. The advantage of structural model is
   A. Require a good and reliable understanding
   B. Depends on the assumptions &mathematical ability
   C. Require an actual operating process
   D. Provide fundamental &general knowledge

ANSWER: D. Provide fundamental &general knowledge

3. Models blending fundamental and empirical knowledge are referred to as

   A. Gray-box models
   B. Black-box models
   C. White-box models
   D. Empirical models

ANSWER: A. Gray-box models

4. The examples for structured models in conservative equation is

   A. Reaction and phase equilibrium
   B. PID control law
   C. Mass of individual chemical species
   D. Transport rate

   ANSWER: C. mass of individual chemical specie

5. The FOPDT Model is an example of
   A. Structured models
   B. Unstructured models
   C. Hybrid models
   D. None of the above

ANSWER: B. Unstructured models

6. Pick the advantages of black-box models from the following:
   A. They don't allow extrapolation
   B. Very limited assumptions required
   C. Just focus on the range of process operating conditions
   D. Both B and C

ANSWER: D. Both B and C

7. Which model stimulates the internal combustion engine operation?

   A. Hybrid models
   B. Structured models
   C. Unstructured models
   D. None of the above

ANSWER: C. unstructured models

8. Curve fitting can involve

   A. Interpolation
   B. Smoothing
   C. Neither A nor B
   D. Both A and B

ANSWER: D. Both A and B

9. The extrapolation method comes under the

   A. Structured models
   B. Fitting or Empirical models
   C. Unstructured models
   D. Hybrid models

ANSWER: B. Fitting or empirical models

10. The unstructured models are a comparison of

   A. Data-rich and theory-poor
   B. Theory-rich and data-poor
   C. Mass and energy balance
   D. Only data poor

ANSWER: A. Data -rich and theory poor

1.5 **PURPOSE OF PHYSIOLOGICAL MODELING ANDSIGNAL ANALYSIS**

GOURY NANDANA KS
211241101014

1.What is physiological modelling?

A. A method of predicting physiological responses to stimuli or interventions.
B. A method of measuring physiological responses to stimuli or interventions.
C. A method of treating physiological disorders.
D. None of the above.

ANSWER: A. A method of predicting physiological responses to stimuli or interventions

2.What is the purpose of physiological modelling?

A. To understand the mechanisms underlying physiological processes.
B. To predict the effects of drugs or other interventions on the body.
C. To design new medical devices or treatments.
D. All the above.

ANSWER: D. All the above

3.What are the advantages of physiological modelling?

A. It can reduce the need for animal testing.
B. It can provide insights into complex physiological systems.
C. It can guide the development of new therapies.
D. All of the above.

ANSWER: D. All of the above.

4. Which of the following statement is true for an instrumentational amplifier?

A. the input resistance of both the inputs is very high and does not change as the gain is varied
B. the input resistance of both the inputs is very low and does not change as the gain is varied
C. the input resistance of both the inputs is very high and does change as the gain is varied
D. the input resistance of both the inputs is very low and does change as the gain is varied

ANSWER: A. the input resistance of both the inputs is very high and does not change as the gain is varied

5. Which of the following is not the property of the instrumentation amplifier?

A. Extremely high input impedance
B. Low bias and offset currents
C. High slew rate

D. Very low CMRR

ANSWER: D. Very low CMRR

6. CMRR is measured in _____

A. v/s
B. dB
C. dB/s
D. dB/ms

ANSWER: B. dB

7._____are commonly used for providing protection against leakage currents.

A. Isolation amplifiers
B. Differential amplifiers
C. Instrumentational amplifiers
D. Inverting amplifiers

ANSWER: A. Isolation amplifiers

8. What types of physiological models are commonly used?

A. Mathematical models.
B. Computational models.
C. In vitro models.
D. All of the above.

ANSWER: D. All of the above.

9. Which on the following is not a type of isolation amplifier?

A. Capacitively coupled isolation amplifiers
B. optically isolated isolation amplifiers
C. resistive coupled isolation amplifiers
D. transformer type isolation amplifiers

ANSWER: C. resistive coupled isolation amplifiers

10. Electromagnetic coupling cannot be reduced by _____

A. shielding
B. wire twisting
C. multiple grounding
D. common grounding

ANSWER: C. multiple grounding

1.6 TYPES OF MODELS

JAYASHREE N R
211241101021

1.Which is based on mechanisms / underlying phenomena

A. Empirical
B. Mechanistic
C. Stochastic
D. Deterministic

ANSWER: B. Mechanistic

2. Deterministic based on

A. Cause-effect analysis
B. Input-output data,trials or experiments
C. Mechanisms / underlying phenomena
D. Superposition principle

ANSWER: A. Cause-effect analysis

3. Hybrid model contains

A. Only defined for discrete values of time and / or space
B. Model elements that are probabilistic in nature
C. Continuous and discrete behaviour
D. Cause-effect analysis

ANSWER: C. Continuous and discrete behaviour

4. Input-output data,trials or experiments based on

A. Mechanistic
B. Empirical
C. Hybrid
D. Deterministic

ANSWER: B. Empirical

5. Which is not a types of model

A. Static and dynamic
B. Discrete and continuous
C. Linear and non-linear
D. Stable and unstable

ANSWER: D. Stable and unstable

6. A model that calculates the system in equilibrium is called

A. Discrete
B. Linear
C. Static
D. Explicit

ANSWER: C. Static

7. A model uses parameters that are constant and do not vary throughout a stimulation is called

A. Static
B. Linear
C. Explicit
D. Discrete

ANSWER: B. Linear

8. Explicit model

A. Calculates the state of a system at a using the past time from current time
B. Solution is obtained by solving an equation involving both the current state and later one
C. Treats objects as discrete
D. Calculate the system in equilibrium

ANSWER: A. Calculates the state of a system at a using the past time from current time

9. Black box model is a

A. System where all necessary information is available
B. System of which there is no prior information available
C. Existing theory and begins with hypothesis
D. Logical structure based on theory

ANSWER: B. System of which there is no prior information available

10.Which is dependent variables are a function of spatial position

A. Hybrid
B. Discrete
C. Linear
D. Distributed parameters

ANSWER: D. Distributed parameters

1.7 PRINCIPLES OF FORMULATION

AFREEN J
211241101002

1.The model formulation process consists of_____.

A. Deriving a mathematical description
B. The condition of the environment
C. Both a and b
D. None of the above

ANSWER: C. Both a and b

2.The description of a system and the development of model requires the concept of

A. Control volume
B. Control mass
C. System control
D. None of these

ANSWER: A. Control volume

3._____ is an example of a model with one variable and one parameter.

A. Solow model
B. Malthus's model
C. None of these
D. Both A & B

ANSWER: B. Malthus's model

4._____models of chemical process consists of ordinary differential equations.

A. Static
B. Active
C. Kinetic
D. Dynamic

ANSWER: D. Dynamic

Process modeling is both an _____

A. Technology and development
B. Art and science
C. Modelling and basics

ANSWER: B. Art and science

6._____is required to make simplifying assumptions that result in an appropriate model.

A. Creativity
B. Knowledge
C. Power
D. Technology

ANSWER: A. Creativity

7.Models involving_____.

A. Transport phenomena
B. Export
C. Standard
D. Ordinary

ANSWER: A. transport phenomena

8. The model equations are at best an appropriate to the_____.

A. Ordinary process
B. Fake process
C. Bio process
D. Real process

ANSWER: D. Real process

9.Mathematical models can be useful in all phases of_____-.

A. Chemical engineering
B. Thermal engineering
C. Electrical engineering
D. Engineering development

ANSWER: A.Chemical engineering

10.The bases for mathematical models are the_____.

A. Fundamental laws
B. Chemical laws
C. Physical laws
D. All the above

ANSWER: D. All the above

1.8 USES OF MATHEMATICAL MODEL

MENAKA.G
211241101029

1. Mathematical model based on_____

   A. Qualitative process theory.
   B. Statistical regression theory.
   C. Fourier theory.
   D. Communication theory.

ANSWER: B. Statistical regression theory.

2. Solid modelling techniques uses boolean set operation to create complex object is_____

   A. Constructive solid geometry.
   B. Boundary representation.
   C. Cell decomposition.
   D. Spatial enumeration.

ANSWER: A. Constructive solid geometry.

3.Dynamic models of chemical processes consists of_____

   A. Ordinary differential equations (ODE).
   B. Partial differential equations (PDE).
   C. Plus related algebraic equations.
   D. All of the above.

ANSWER: D. All of the above.

4.Mathematical model based on the_____

   A. Stochastic process model.
   B. Stochastic evolution laws.
   C. Statistical regression theory.
   D. Both B and C.

ANSWER: D. Both B and C.

5. The stochastic process can be transformed by the use of specific theorem as well as various stochastic deformed models, more commonly called_____

   A. Rigid model.
   B. Diffusion model.
   C. Physical model.
   D. Potential model.

ANSWER: B. Diffusion model.

6. Which model are used in chemical engineering consequently, it is not simple to Propose a class grouping for models?

A. Highly - diversified model.
B. Device model.
C. Plant model.
D. Non - deterministic model.

ANSWER : A. Highly - diversified model.

7. Which one of the following statement related to modelling of system dynamics is NOT true?

A. The transfer function is not changed by a linear transformation of state.
B. A given state description can be transferred to a controlled canonical form if the controllability matrix is nonsingular.
C. A change of state by a nonsigular linear transformation does not change.
D. Zero cannot be computed from it's state description matrices.

ANSWER: C. A change of state by a nonsigular linear transformation does not change.

8. If we consider only the mean values of the parameters and variables of one model with randomly distributed parameter or input variables, then which model we transform into a rigid model?

A. Diffusion model.
B. Non - deterministic model.
C. Stochastic model.
D. None of the above.

ANSWER: B. Non - deterministic model.

9. The model associated to a process with no randomly distributed input variable or parameters are called_____

A. Plant model.
B. Device model.
C. Physical model.
D. Rigid model.

ANSWER: D. Rigid model.

10. Mathematical model can be useful in all phase of_____

A. Chemical engineering.
B. Business and economic studies.
C. All the above.
D. None of the above.

ANSWER: C. All the above.

1.9 TECHNIQUES OF MATHEMATICAL MODELLING

PRIYANKA. H
211241101035

1. Which of the following is not a common technique used in mathematical modelling?

   A. Differential equations
   B. Statistics
   C. Calculus
   D. Graph theory

ANSWER: D. Graph theory

2. In mathematical modelling, what is a system?

   A. A set of equations
   B. A set of data
   C. A set of variables and their relationships
   D. A set of constants

ANSWER: C. A set of variables and their relationships

3. Which of the following is an example of a continuous system?

   A. Population growth
   B. Bank deposits
   C. Customer arrivals at a store
   D. Number of cars passing through a toll booth

ANSWER: A. Population growth

4. Which of the following is not a step in the mathematical modelling process?

   A. Collecting data
   B. Formulating assumptions
   C. Solving the problem analytically
   D. Testing the model with real-world data

ANSWER: C. Solving the problem analytically

5. Which type of model would be used to analyze the spread of a disease through a population?

   A. Deterministic model
   B. Stochastic model
   C. Linear model
   D. Nonlinear model

ANSWER: B. Stochastic model

6. What is a sensitivity analysis?

   A. A technique for analyzing the robustness of a model to changes in its assumptions or parameters

B. A technique for reducing the complexity of a model
C. A technique for optimizing a model's parameters
D. A technique for testing a model's predictions against real-world data

ANSWER: A. A technique for analyzing the robustness of a model to changes in its assumptions or parameters

7. Which of the following is an example of a black-box model?

A. A linear regression model
B. A neural network model
C. A decision tree model
D. A time series model

ANSWER: B. A neural network model

8. What is the purpose of calibration in mathematical modelling?

A. To validate the model's predictions against real-world data
B. To optimize the model's parameters
C. To test the model's robustness to changes in its assumptions or parameters
D. To simplify the model by reducing its complexity

ANSWER: B. To optimize the model's parameters

9. What is a Monte Carlo simulation?

A. A simulation technique for testing the robustness of a model to changes in its assumptions or parameters
B. A simulation technique for optimizing a model's parameters
C. A simulation technique for analyzing the impact of uncertainty on a model's predictions
D. A simulation technique for testing a model's predictions against real-world data

ANSWER: C. A simulation technique for analyzing the impact of uncertainty on a model's predictions

10. What is the main advantage of using a simulation model in mathematical modelling?

A. It provides an exact solution to the problem being modeled
B. It is simpler and easier to use than other types of models
C. It allows for the analysis of complex systems and interactions between variables
D. It does not require any assumptions to be made about the system being modeled

ANSWER: C. It allows for the analysis of complex systems and interactions between variables.

1.10 MATHEMATICAL MODELS

SIMRAN. M
211241101042

1.General conservation law is the most well known example of_____

A. Scalar principle
B. Vector quantities
C. Fundamental principles
D. Net generation

ANSWER: C. Fundamental principles

2.Input-output+net generation=?

A. Accumulation
B. Chemical element
C. Disappearance
D. Biochemical bonding

ANSWER: A. Accumulation

3.The mathematical model of population growth was posted by_____

A. Pierre Verhulst
B. Thomas R. Malthus
C. Claude Bernard
D. Jean Fernel

ANSWER: B. Thomas R. Malthus

4.Which law is applied to no. of. Individuals in a closed system?

A. Time series
B. Newton's law
C. General conservation law
D. None of the above

ANSWER: C. General conservation law

5.What is the example of transport phenomena?

A. Newton law of viscosity
B. 1st Fick law of diffusion
C. Fourier law of heat conduction
D. All the above

ANSWER: D. All the above

6.The population balance equation was originally derived in the year_____

A. 1967
B. 1963
C. 1964
D. 1973

ANSWER: C. 1964

7. The equation of general conservation law is_____

A. N=CN(t)
B. N=C(Nt)
C. N=C°(t)
D. N(t) =CN(t)

ANSWER: A. N=CN(t)

8. What are the elements necessary for a population balance model?

A. Entity
B. Entity distribution
C. Both A and B
D. None of the above

ANSWER: C. Both A and B

9. The logistic model was developed by _____

A. Claude Bernard
B. Thomas R. Malthus
C. Pierre Verhulst
D. Jean Fernal

ANSWER: C. Pierre Verhulst

10. The general law of transport phenomena is ____

A. Flux=transfer coefficient×spacial gradient
B. GEN=birth-death
C. Both A and B
D. Neither A nor B

ANSWER: A. Flux=transfer coefficient×spacial gradient

1.11 INTRODUCTION TO MATHEMATICAL MODELLING

UDHAYA KUMAR. P
211241101050

1. In mathematical modeling of a process, which option is not a characteristics of an analytical solution?

A. Mathematical equations are used to describe a process
B. Most practical problems cannot be solved
C. Exact information on the quantities of interest is obtained
D. Finite element method is used

ANSWER: D. Finite element method is used

2. In mathematical modeling of a process, which option is not a characteristics of a Numerical solution method?

A. It does not give exact information on the quantities of interest
B. A set of assumptions are made about the process
C. Applicable to simple problems only
D. Finite element method is used

ANSWER: C. Applicable to simple problems only

3. Which is considered to be a numerical computation technique used in conjunction with dynamic mathematical models?

A. Analysis
B. System simulation
C. Dynamic computation
D. None of the above

ANSWER: B. System simulation

4. Which system / model applies computational procedures to solve equations?

A. Dynamic model
B. Static model
C. Analytical model
D. Numerical model

ANSWER: D. Numerical model

5. Which system / model applies deductive reasoning of mathematical theory to solve a model?

A. Dynamic model
B. Static model
C. Analytical model
D. Numerical model

ANSWER: C.Analytical model

6. Which model follows the changes over time that results from the system activities?

A. Dynamic model
B. Static model
C. Analytical model
D. Numerical model

ANSWER: A. Dynamic model

7. Which model can only show the values that system attributes take when the system is in balance?

A. Dynamic model
B. Static model
C. Analytical model
D. Numerical model

ANSWER: B. Static model

8. Dynamic model typically are represented by

A. Differential equations
B. Difference Eq^n
C. Both A and B
D. None of the above

ANSWER: C. Both A and B

9. Which is a logical structure based on theory?

A. Deductive model
B. Inductive model
C. Floating model
D. Constant model

ANSWER: A. Deductive model

10. A finite mathematical model is called

A. Regularly perturbed
B. Singularly perturbed
C. Both A and B
D. None of the above

ANSWER: C. Both A and B

1.12 TIME VARIANT AND TIME INVARIANT SYSTEM

YAMUNA SRI.S

211241101058

1. A system is said to be time variant if

   A. Output characteristics do not change with time
   B. Input-output characteristics change with time
   C. Input-output characteristics do not change with time
   D. Input characteristics do not change with time

ANSWER: B. Input-output characteristics change with time

2. The system $y(t)=x(2t)+3$ is

   A. Linear and time-invariant
   B. Non-linear and time-variant
   C. Linear and memoryless
   D. Causal and linear

ANSWER: B. Non-linear and time-variant

3. Time-variant is also known as

   A. Shift variant
   B. Output variant
   C. Shift invariant
   D. Output invariant ANSWER: A. Shift variant

4. A system is said to be time invariant if

   A. Input characteristics do not change with time
   B. Output characteristics change with time
   C. Input-output characteristics do not change with time
   D. Input-output characteristics change with time

ANSWER: C. Input-output characteristics do not change with time

5. Time-invariant is also known as

   A. Output invariant
   B. Shift variant
   C. Shift invariant
   D. Output variant ANSWER: C. Shift invariant

6. Which of the following systems are time-invariant?

   A. $y(t)=x(t)$
   B. $y(t)=x(t)+tx(t-1)$
   C. $y(t)=tx(t)$
   D. $y(t)=t^2x(t-1)$

ANSWER: A. $y(t)=x(t)$

7. If the system input-output relationship varies with time, then it is said to be

A. Time-variant
B. Time-invariant
C. Continuous
D. Discrete

ANSWER: A. Time-variant

8. The input x(t) and output y(t) of a continous-time system are related as:

$y(t)=\int_{t-T}^{t} x(u)\,du$, then the system is,

A. Linear and time-variant
B. Non-linear and time-invariant
C. Linear and time-invariant
D. Non-linear and time-variant

ANSWER: C. Linear and time-invariant

9. Which is the right equation of time variant?

A. $x(n-k)\xrightarrow{T}y(n-k)$
B. $x(n)\xrightarrow{T}y(n-k)$
C. $x(n-k)\xrightarrow{T}y(k)$
D. $x(n-k)\xrightarrow{T}y(n-k)$

ANSWER: D. $x(n-k)\xrightarrow{T}y(n-k)$

10. Which is the right equation of time invariant?

A. $x(n-k)\xrightarrow{T}y(n-k)$
B. $x(n-k)\xrightarrow{T}y(k)$
C. $x(n)\xrightarrow{T}y(k)$
D. $x(n)\xrightarrow{T}y(n-k)$

ANSWER: A. $x(n-k)\xrightarrow{T}y(n-k)$

UNIT - 2 NONPARAMETRIC AND PARMETRIC MODELING

2.1 PARAMETRIC MODELS

RESHMAK
211241101036

1. Which of the characteristics is the parametric model?

   A. It does not make assumptions about the describe of the data.
   B. It uses large number of parameters to describe the data.
   C. It assumes that the data is generated from a specific probability distribution.
   D. It is only used for linear regression.

ANSWER: C. It assumes that the data is generated from a specific probability distribution.

2. What is the purpose of a Parametric model in statistics?

   A. To describe the distribution of the data.
   B. To make predictions about future data.
   C. To determine the between two variables.
   D. To calculate summary statistics

ANSWER: B. To make predictions about future data.

3. In a liner regression model. Which of the following is the parameter?

   A. The intercept.
   B. The slope.
   C. Both the intercept and the slope.
   D. The standard error.

ANSWER: C. Both the intercept and the slope.

4. Which of the following is an advantage of using a Parametric model?

   A. It can handle non-linear relationships between variables.
   B. It is less computationally intensive than non-parametric models.
   C. It is not affected by outliers in the data.
   D. It can be used with any type of data.

ANSWER: B. It is less computationally intensive than non-parametric models.

5. In a logistic regression model, what is the parameter that is estimated?

   A. The mean of the response variable.
   B. The variance of the response variable.
   C. The probability of the response variable taking on a particular value.
   D. The correlation between the predictor and response variables.

ANSWER: C. The probability of the response variable taking on a particular value.

6. Which of the following is an example of a Parametric model?

A. K- nearest neighbors.
B. Decision tree.
C. Naive Bayes.
D. Linear regression.

ANSWER: D. Linear regression.

7. In a Parametric model, what is the role of the likelihood function?

A. To estimate the parameters of the model.
B. To determine the distribution of the data.
C. To calculate the standard error of the estimates.
D. To assess the goodness of fit of the model.

ANSWER: A. To estimate the parameters of the model.

8. Which of following is a limitation of using a Parametric model?

A. It assumes a specific functional form for the relationship between variables.
B. It is not able to handle missing data.
C. It requires a large sample size to produce accurate results.
D. It is not able to handle non-normal distributions.

ANSWER: A. It assumes a specific functional form for the relationship between variables.

9. What is the difference between a Parametric model and non-parametric model?

A. Parametric models make assumptions about the underlying distribution of the data, while non-parametric models do not.
B. Parametric models use a fixed number of Parameters, while non-parametric models use an unlimited number of parameters.
C. Parametric models are less sensitive to outliers in the data, while non-parametric models are more sensitive to outliers.
D. Parametric models are only used for regression problems, while non-parametric models can be used for both regression and classification problems.

ANSWER: A. Parametric models make assumptions about the underlying distribution of the data, while non-parametric models do not.

10. Which of the following is an example of Parametric model used in machine learning?

A. Random forest.
B. K-means clustering.
C. Support vector machines.
D. Linear regression.

ANSWER: D. Linear regression

2.2 BASIC PARAMETRIC MODEL FORMS AND ESTIMATION PROCEDURES

MINISHA.S

211241101030

1. What type of model is used to estimate the parameters of a normal distribution?

   A. Binomial Model
   B. Poisson Model
   C. Normal Model
   D. Exponential Model

ANSWER: C. Normal Model

2. What is the process of finding the best estimates of mode parameters called?

   A. Prediction
   B. Inference
   C. Estimation
   D. Model Selection

ANSWER: C. Estimation

3. Which method is used to estimate parameters when the data follows a Poisson distribution?

   A. Maximum Likelihood Estimation (MLE)
   B. Maximum a Posteriori Estimation (MAP)
   C. Method of Moments (MOM)
   D. Bayesian Inference

ANSWER: A. Maximum Likelihood Estimation (MLE)

4. Which estimation procedure assumes that the errors are normally distributed and homoscedastic?

   A. Ordinary Least Squares (OLS)
   B. Weighted Least Squares (WLS)
   C. Generalized Least Squares (GLS)
   D. Nonlinear Least Squares (MLS)

ANSWER: A. Ordinary Least Squares (OLS)

5. Which of the following models is used for binary outcome data?

   A. Linear Regression Model
   B. Logistic Regression Model
   C. Poisson Regression Model
   D. Exponential Regression Model

ANSWER: B. Logistic Regression Model

6. Which of the following models is used to model count data?

   A. Linear Regression Model
   B. Logistic Regression Model

C. Poisson Regression Model
D. Exponential Regression Model

ANSWER: C. Poisson Regression Model

7. In Bayesian Inference what is the distribution used to represent prior Knowledge about the parameters?

A. Posterior Distribution
B. Likelihood Function
C. Prior Distribution
D. Joint Distribution

ANSWER: C. Prior Distribution

8. Which of the following models is used for continuous outcome data that is positively skewed?

A. Linear Regression Model
B. Logistic Regression Model
C. Gamma Regression Model
D. Weibull Regression Model

ANSWER: C. Gamma Regression Model

9. What is the process of finding the best set of parameters that minimize the residual sum of squares called?

A. Maximum Likelihood Estimation (MLE)
B. Maximum a Posteriori Estimation (MAP)
C. Method of Moments
D. Ordinary Least Squares

ANSWER: D. Ordinary Least Squares

10. Which of the following models is used for continuous outcome data that is right skewed?

A. Linear Regression Model
B. Logistic Regression Model
C. Gamma Regression Model
D. Weibull Regression Model

ANSWER: D. Weibull Regression Model

2.3 VOLTERRA KERNELS MEASUREMENTS TO PARAMETRIC MODELS

DIVYA SRI. S
211241101011

1. What is a Volterra kernel in Signal processing?

   A. A mathematical representation of a system's behavior
   B. A model for linear system
   C. A nonlinear model for signals
   D. A model for continuous signals

ANSWER: C. A nonlinear model for signals

2. What is the main difference between Volterra kernels and traditional linear models?

   A. Volterra kernels are time invariant
   B. Volterra kernels are Linear models
   C. Volterra kernels can model nonlinear systems
   D. Volterra kernels are only used for digital signals

ANSWER: C. Volterra kernels can model nonlinear systems

3. How can Volterra kernels be used to model a nonlinear system?

   A. By modeling the output as a Linear combination of input signals
   B. By modeling the output as a Linear combination of input signals and nonlinear functions of input signals
   C. By modeling the output as a nonlinear combination of input signals
   D. By mode the output as a nonlinear combination of input signals and linear functions of input signals

ANSWER: B. By modeling the output as a Linear combination of input signals and nonlinear functions of input signals

4. What are some of the advantages of using Volterra kernels to model nonlinear systems?

   A. They are faster to compute than other models
   B. They can model a wider range of systems than traditional linear models
   C. They can provide more accurate representations of the system behavior
   D. All of the above

ANSWER: D. All of the above

5. Can Volterra kernels be used to model systems with multiple inputs?

   A. No, on only single input systems can be modeled with Volterra kernels
   B. Yes, systems with multiple inputs be modeled using Volterra kernels
   C. They are faster to compute than other models
   D. None of the above

ANSWER: B. Yes, systems with multiple inputs be modeled using Volterra kernels

6.Can Volterra kernels be used to model systems with non-stationary signals?

A. Yes, Volterra kernels can model non – stationary signals
B. No, only stationary signals can be modeled with Volterra kernels
C. They can provide more accurate representations of the system behavior
D. None of the above

ANSWER: A. Yes, Volterra kernels can model non – stationary signals

7.What is the relationship between Volterra kernels and parametric models?

A. Volterra kernels are a type of parametric model
B. Volterra kernels can be used to estimate parameters for parametric models
C. Parametric models can be used to estimate Volterra kernels
D. Volterra kernels and parametric models are completely unrelated

ANSWER: B. Volterra kernels can be used to estimate parameters for parametric models

8.Can Volterra kernels be used to model linear systems?

A. Yes, Volterra kernels can be used to model linear systems
B. No, Volterra kernels are only used to model nonlinear systems
C. Yes, Volterra kernels are only used to model nonlinear systems
D. No, Volterra kernels can be used to model linear systems

ANSWER: A. Yes, Volterra kernels can be used to model linear systems

9.Can Volterra kernels be used to model systems in real-time?

A. Yes, Volterra kernels can be used to model systems in real-time
B. No, Volterra kernels are too computationally intensive for real time use
C. No, Volterra kernels can be used to model systems in real-time
D. Yes, Volterra kernels are too computationally intensive for real time use

ANSWER: A. Yes, Volterra kernels can be used to model systems in real-time

10. What is the main advantage of using Volterra kernels than other nonlinear models for signal processing?

A. Volterra kernels provide more accurate representations of the system behavior
B. Volterra kernels are faster to compute than other nonlinear models
C. Volterra kernels can model a wider range of systems than other nonlinear models
D. All of the above

ANSWER: C. Yes, Volterra kernels can model a wider range of systems than other nonlinear models

2.4 BASIC PARAMETRIC MODELFORMS AND ESTIMATION PROCEDURES

HEMA. RGS

211241101017

1.What is a Volterra Kernal in mathematics?

A. A matrix representing linear transformation
B. A function representing the solution of a linear differential equation
C. A function representing the solution of a non-linear integral equation
D. A function representing the solution of a linear integral equation

ANSWER: C. A function representing the solution of a non-linear integral equation

2.What type of equation is a Volterra equation?

A. Linear partial differential equation
B. Non-linear ordinary differential equation
C. Linear ordinary differential equation
D. Non-linear integral equation

ANWER: D. Non-linear integral equation

3.What is the main difference between Volterra and Fredholm integral equation?

A. Volterra equations have a linear kernel while Fredholm equations have a non-linear kernel
B. Fredholm equations have a linear kernel while Volterra equations have a non-linear kernel
C. Both have linear kernel
D. Both have non-linear kernel

ANSWER: B. Fredholm equations have a linear kernel while Volterra equations have a non-linear kernel

4.What is the main advantage of using Volterra kernels to solve non-linear differential equations?

A. They are computationally efficient
B. They provide analytical solutions
C. They can handle nonlinearities
D. They are widely used in engineering applications

ANSWER: C. They can handle nonlinearities

5.What are the applications of Volterra kernels?

A. Image processing
B. Climate modelling
C. Financial modelling
D. All the above

ANSWER: D. All the above

6. What is the numerical method used to solve Volterra equations?

A. Finite difference method
B. Finite element method
C. Collocation method
D. All of the above

ANWER: D. All of the above

7. What is the main disadvantage of using Volterra kernels?

A. They are computationally inefficient
B. They do not provide analytical solutions
C. They are limited to only solving non-linear differential equation
D. They are not widely used in engineering applications

ANSWER: A. They are computationally inefficient

8. What is a nonlinear differential equation?

A. An equation that contains only linear terms
B. An equation that contains only nonlinear terms
C. An equation that contains only exponential terms
D. An equation that contains only logarithmic terms

ANSWER: B. An equation that contains only nonlinear terms

9. Can Volterra kernels be used to solve linear differential equations?

A. Yes, they can be used to solve linear differential equations
B. No, they can only be used to solve nonlinear differential equations
C. They can only be used to solve linear integral equations
D. They can only be used to solve nonlinear integral equations

ANWER: B. No, they can only be used to solve nonlinear differential equations

10. What is the general form of a Volterra equation?

A. $y(t) = \int_0^t K(t.s)y(s)\, ds$

B. $y(t) = \int_0^t K(t.s)f(s)\, ds$

C. $y(t) = \int_t^T K(t.s)\, y(s)\, ds$

D. $y(t) = \int_t^T K(t.s)\, f(s)\, ds$

ANSWER: B. $y(t)) = \int_0^t K(t.s)\, f(s)\, ds$

2.5 DISCRETE TIME VOLTERRA KERNEL OF NARMAX MODELS

JANANI . B
211241101018

1. What is the role of the Volterra kernels in NARMAX models?

   A. It models the nonlinearity of the system
   B. It models the linearity of the system
   C. It models the time delay of the system
   D. None of the above

ANSWER: A. It models the nonlinearity of the system

2. Which of the following statements is true about the Volterra kernels of a NORMAX model?

   A. It is a time – invariant function
   B. It is a time – varying function
   C. It is a linear function
   D. It is a nonlinear function

ANSWER: D. It is a nonlinear function

3. How many orders of the Volterra kernels are typically used in practice?

   A. 1
   B. 2
   C. 3
   D. 4

ANSWER: B. 2

4. Which of the following is a disadvantage of using high -order Volterra kernels in NARMAX models?

   A. They are computationally expensive
   B. They require a lot of data for estimation
   C. They can lead to overfitting
   D. All of the above

ANSWER: D. All of the above

5. How can the Volterra kernels be estimated for a NORMAX model?

   A. Using a recursive least squares algorithm
   B. Using a gradient descent algorithm
   C. Using a genetic algorithm
   D. None of the above

ANSWER: A. Using a recursive least squares algorithm

6. Which of the following is a disadvantage of using a low-order Volterra kernels in a NORMAX model?

A. It may not capture all the nonlinear dynamics of the system
B. It may be too complex to estimate
C. It may require too much data for estimation
D. None of the above

ANSWER: A. It may not capture all the nonlinear dynamics of the system

7. Which of the following is an advantage of using a Volterra kernels in a NORMAX model?

A. It can model a wide range of nonlinear dynamics
B. It is computationally efficient
C. It requires less data for estimation than other models
D. None of the above

ANSWER: A. It can model a wide range of nonlinear dynamics

8. Which of the following is a limitation of using a Volterra kernel in a NORMAX model?

A. It assumes the system is time – invariant
B. It assumes the system is linear
C. It assumes the input and output of the system are Gaussian
D. None of the above

ANSWER: C. It assumes the input and output of the system are Gaussian

9. Which of the following is an example of a system that can be modeled using a NORMAX model with a Volterra kernel?

A. A linear time – invariant system
B. A nonlinear time-varying system
C. A linear time -varying system
D. None of the above

ANSWER: B. A nonlinear time – varying system

10. Which of the following is a disadvantage of using NORMAX model with a Volterra kernel compared to other nonlinear models?

A. It is less accurate
B. It is a less interpretable
C. It is less computationally efficient
D. None of the above

ANSWER: C. It is less computationally efficient

2.6 PARAMETRIC AND NON PARAMETRIC EQUIVALENCE BETWEEN CONTINOUS AND DISCRETE

JAYA PRAKASH. E
211241101020

1. What is the main difference between continuous and discrete variables?

   A. Continuous variables can take on any value within a range, while discrete variables can only take on certain specific values.
   B. Continuous variables can only take on certain specific values, while discrete variables can take on any value within a range.
   C. There is no difference between continuous and discrete variables.
   D. Both continuous and discrete variables can take on any value within a range.

ANSWER: A. Continuous variables can take on any value within a range, while discrete variables can only take on certain specific values.

2. Which of the following is an example of a continuous variable?

   A. Number of cars in a parking lot.
   B. Number of students in a classroom.
   C. Temperature in a room.
   D. Type of fruit in a basket.

ANSWER: C. Temperature in a room.

3. Which of the following is an example of a discrete variable?

   A. Height of a person.
   B. Weight of a person.
   C. Number of children in a family.
   D. Time taken to complete a task.

ANSWER: C. Number of children in a family.

4. What type of data is represented by a histogram?

   A. Continuous data.
   B. Discrete data.
   C. Both continuous and discrete data.
   D. None of the above.

ANSWER: A. Continuous data.

5. What type of data is represented by a bar chart?

   A. Continuous data.
   B. Discrete data.
   C. Both continuous and discrete data.
   D. None of the above.

ANSWER: B. Discrete data.

6. Which of the following is true about the mean of a continuous variable?

A. It can be calculated exactly.
B. It can only be estimated.
C. It does not exist.
D. It is always equal to the mode.

ANSWER: B. It can only be estimated.

7. Which of the following is true about the variance of a discrete variable?

A. It can be negative.
B. It can be zero.
C. It can only be positive.
D. It does not exist.

ANSWER: C. It can only be positive.

8. Which of the following is true about the standard deviation of a continuous variable?

A. It is always positive.
B. It can be negative.
C. It can be zero.
D. It does not exist.

ANSWER: A. It is always positive.

9. Which of the following is true about the median of a discrete variable?

A. It can be any value within the range of the data.
B. It must be one of the values in the data.
C. It can only be estimated.
D. It is always equal to the mode.

ANSWER: B. It must be one of the values in the data.

10. Which of the following is true about the mode of a continuous variable?

A. It can be any value within the range of the data.
B. It must be one of the values in the data.
C. It can only be estimated.
D. It does not exist.

ANSWER: A. It can be any value within the range of the data.

2.7 MATHEMATICAL MODEL OF LOTKA VOLTERRA

BALAJI.S
211241101005

1. What does the variable "N" represent in the Lotka-Volterra model?

   A. The population growth rate of the prey species
   B. The preparation rate coefficient
   C. The population of the prey species
   D. The conversion efficiency of prey biomass into predator biomass

ANSWER: C. The population of the prey species

2. What does the variable "p" represent in the Lotka-Volterra model?

   A. The population growth rate of the predator species
   B. The predation rate coefficient
   C. The population of the predator
   D. The conversion efficiency of prey biomass into predator biomass

ANSWER: C. the population of the predator

3. Which equation in the Lotka-Volterra model represent the population growth of the prey species?

   A. dN/dt = rN – aNP
   B. Dp/ dt= Cp+ baNP
   C. Both equations represent the population growth of the prey species
   D. Neither equations represent the population growth of the prey species

ANSWER: A. dN /dt = Rn - aNP

4. Which equation in the Lotka-Volterra model represent the population growth of the Predator species?

   A. dN/dt = rN – aNP
   B. dp/ dt = cp+ baNP
   C. Both equations represent the population growth of the predator species
   D. Neither equations represent the population growth of the predator species

ANSWER: B. dp/dt = cp+baNP

5. What does the Lotka-Volterra model predict about the population sizes of predator and prey species?

   A. They will both increase indefinitely
   B. They will both decrease indefinitely
   C. They will both stabilize at a fixed population size
   D. They will oscillate in a cyclical pattern

ANSWER: D. They will oscillate in a cyclical pattern

6. What happens to the population of the predator species if the predation rate coefficient ”a” decreases?

A. It increases
B. It decreases
C. It remains the same
D. It is impossible to determine

ANSWER: B. It decreases

7. What happens to the predator population if the predator death rate “c” increases?

A. It increases
B. It decreases
C. It remains the same
D. It is impossible to determine

ANSWER: B. It decreases

8. What happens to the population of the predator species if the prey rate coefficient ”b” decreases?

A. It increases
B. It decreases
C. It remains the same
D. It is impossible to determine

ANSWER: A. It increases

9. Which parameter in the Lotka-Volterra model represents the predator’s efficiency in converting prey biomass into predator biomass?

A. r
B. a
C. c
D. b

ANSWER: B. a

10. What is equilibrium point in the Lotka-Voltera model?

A. The point where the predator and prey populations stabilize at a fixed populations size
B. The point where the predator population goes extinct
C. The point where the prey population goes extinct
D. The point where the predator and prey populations are at their maximum values

ANSWER: A. The point where the predator and prey populations stabilize at a fixed populations size

2.8 LOTLKA VOLTERRA

VALARMATHI S
211241101051

1.What does the Lotka Volterra model describes?

A. Population dynamics between predator and prey
B. The relationship between climate change and species survival
C. The effect of pesticides on agriculture system
D. The growth rate of single population.

ANSWER: A. Population dynamics between predator and prey

2.What is the basic assumption of Lotka Volterra model?

A. The population of both predator and prey grow at a steady rate
B. The population of both predator and prey experience random fluctuation
C. The population of predator and prey are linked by a linear relationship
D. The population of prey and predator are independent of each other

ANSWER: C. The population of predator and prey are linked by a linear relationship

3.what does the "prey equation" in Volterra model describes?

A. The rate of increases in the predator population
B. The rate of decreases in the prey population due to predation
C. Carrying capacity of the prey population
D. The amount of resource available to the prey population

ANSWER: B. The rate of decreases in the prey population due to predation

4.what does the "predator equation" in Volterra model describes?

A. The rate of increases in the prey population
B. The rate of decreases in the predator population due to competition
C. The carrying capacity of the predator population
D. The amount of resources available to the predator population

ANSWER: A. The rate of increases in the prey population

5.In the Lotka Volterra model what does the parameter "a" represent?

A. The rate at which the predator population grow
B. The rate at which the prey population grow
C. The rate at which the predator consume prey
D. The rate at which the prey reproduce

ANSWER: C. The rate at which the predator consume prey

6.What is the equilibrium point in the Lotka Volterra model?

A. The point at which the predator population goes extinct
B. The point at which the prey population goes extinct

C. The point at which both prey and predator population are stable
D. The point at which the both prey and predator population are growing rapidly

ANSWER: C. The point at which both prey and predator population are stable

7.What happens to the predator population if the prey population increases?

A. The predator population also increases
B. The predator population decreases
C. The predator population remains the sane
D. The predator population becomes extinct

ANSWER: A. The predator population also increases

8.What happens to the prey population if the predator population increases?

A. The prey population also increases
B. The prey population decreases
C. The prey population remains the same
D. The prey population becomes extinct

ANSWER: B. The prey population decreases

9.What is the Lotka Volterra model useful for?

A. Predicting the exact number of predators and prey in a given ecosystem
B. Identifying the factor that affect the prey and predator population
C. Developing strategies for controlling invasive species
D. understanding the effect of climate changes on ecosystem

ANSWER: B. Identifying the factor that affect the prey and predator population

10.What are some limitations of the Lotka Volterra models?

A. It assumes the prey and predator population in direct competition with each other
B. It does not the account for the effect of environmental factors on population dynamics
C. It assumes that all individual within a population are identical
D. It is only applicable to small scale closed ecosystems

ANSWER: B. It does not the account for the effect of environmental factors on population dynamics

2.9 PREDICTION ERROR METHOD

LAVANYA K
211241101027

1.What is the prediction error method?

A. A method for calculating the accuracy of a prediction
B. A method for estimating the variance of a prediction
C. A method for minimizing the prediction error
D. A method for measuring the reliability for a prediction

Answer: A. A method for calculating the accuracy of a prediction.

2. Which of the following is not a type of prediction error?

A. Bias error
B. Sampling error
C. Residual error
D. Inflation error

ANSWER: D. Inflation error

3. What is the purpose of cross validation in prediction error analysis?

A. To assess the performance of a prediction model on new data
B. To estimate the accuracy of a prediction model on a subset of the data
C. To identify the source of error in a prediction model
D. To improve the generalization ability of a prediction model

ANSWER: A. To asses the performance of a prediction model on new data.

4. Which of the following is a measure of prediction error that takes into both bias and variance?

A. Mean absolute error (MAE)
B. Mean squared error (MSE)
C. Root mean squared error (RMSE)
D. mean absolute percentage error (MAPE)

ANSWER: C. Root mean squared error (RMSE)

5. Which of the following is a method for reducing prediction error due to over fitting?

A. Ridge regression
B. Lasso regression
C. Elastic net regression
D. All of the above

ANSWER: D. All of the above

6. Which of the following is not a step in the prediction error analysis process?

A. Pre-processing the data
B. Building the prediction model
C. Interpreting the results
D. Generating the data

ANSWER: D. Generating the data

7. What is the goal of prediction error analysis?

A. To improve the accuracy and reliability of a prediction model
B. To generate new data for analysis
C. To identify the sources of variation in the data
D. To visualize the data in a meaningful way

ANSWER: A. To improve the accuracy and reliability of a prediction model.

8. Which of the following is a measure of the overall performance of a classification model?

A. Mean squared error
B. F1 score
C. Root mean squared error
D. Mean absolute percentage error

ANSWER: B. F1 score

9. Which of the following is a measure of the accuracy of a classification model?

A. Mean squared error
B. Precision
C. Recall
D. Root mean squared

ANSWER: B. Precision

10. Which of the following is a measure of the completeness a classification model?

A. Mean squared error
B. Precision
C. Recall
D. Root mean squared

ANSWER: C. Recall

2.10 PARAMETRIC AND NON PARAMETRIC ESTIMATION ERRORS

MONIKA.S
211241101031

1. What is the definition of an estimation error in parametric analysis?

A. The difference between estimated and actual value of a parameter
B. The variance of the estimated value of a parameter
C. The standard deviation of the actual value of a parameter
D. The difference between the mean and median of parameter

ANSWER: A. The difference between the estimated and actual value of a parameter

2. What is effect of an increase in sample size on estimation and actual value of a parameter?

A. It is increases estimated error
B. It is decreases estimated error
C. It has no effect on estimation error
D. It depends on the type of parameter being estimated

ANSWER: A. It is increases estimated error

3.What is the effect of an increases in variability on estimation error?

A. It is increases estimated error
B. It is decreases estimated error
C. It has no effect on estimation error
D. It depends on the type of parameter being estimated

ANSWER: A. It is increases estimated error

4. Which of the following is not a method for estimating parameters in parametric analysis?

A. Maximum likelihood estimation

B. Method of moments estimation

C. Bayesian estimation

D. Central limit estimation

ANSWER: D. Central limit estimation

5. What is the definition of bias in parametric analysis?

A. The difference between estimated and actual value of a parameter
B. The variance of the estimated value of a parameter
C. The standard deviation of the actual value of parameter
D. The systematic difference between the estimated value and the true value of a parameter

ANSWER: D. The systematic difference between the estimated value and the true value of a parameter

6. What is the definition of consistency in parametric analysis?

A. The ability of an estimator to produce unbiased estimates
B. The ability of an estimator to produce estimates with low variance
C. The ability of an estimator to produce accurate estimates
D. The ability of an estimator to produce estimates that approach the true value as samplesize increases.

ANSWER: D. The ability of an estimator to produce estimates that approach the true valueas sample size increases.

7. What is the effect of larger standard error on estimation error?

A. It increases estimation error
B. It decreases estimation error
C. It has no effect on estimation error
D. It depends on the type of parameter being estimated.

ANSWER: A. It increases estimation error

8. Which of the following is a method for assessing the quality of an estimator error?

A. Goodness of-fit test
B. Confidence interval
C. Test of significance
D. All of the above

ANSWER: D. All of the above

9. What is the effect of a change in the estimation method on estimation error?

A. It always reduces estimation error
B. It always increases estimation error
C. It can either reduce or increase estimation error depending on the method chosen
D. It has no effect on estimation error

ANSWER: C. It can either reduce or increase estimation error depending on the method chosen

10.Which of the following is not a source of estimation error in parametric analysis?

A. Sampling error
B. Measurement error
C. Modeling error
D. Systematic error

ANSWER: D. Systematic error

2.11 WIENER MODELS

VASANTH K
211241101053

1. What is a wiener model used for?

   A. Audio signal processing
   B. Image compression
   C. System identification and control
   D. Text recognition

ANSWER: C. System identification and control

2. What is the main advantages of using a wiener model compared to a linear model?

   A. It is more accurate
   B. It can handle nonlinearities
   C. It is easier to implement
   D. It requires less data for training

ANSWER: B. It can handle nonlinearities

3. What is the basic structure of a wiener model?

   A. A linear filter followed by a nonlinear function
   B. A nonlinear function followed by a linear filter
   C. A single nonlinear function
   D. A single linear filter

ANSWER: D. Linear

4. Which of the following is NOT a commonly used nonlinear function in a wiener model?

   A. Rectified linear unit (RLU)
   B. Sigmoid
   C. Hyperbolic tangent (tanh)
   D. Linear

ANSWER: D. Linear

5. What is the name of the algorithm commonly used to train wiener models?

   A. Gradient descent
   B. Newtons method
   C. Levenberg-Marquardt algorithm
   D. Support vector machines

ANSWER: C. Levenberg-Marquardt algorithm

6. Which of the following is a disadvantages of using a wiener model?

A. It can be computationally expensive to train
B. It is only effective for linear systems
C. It requires a large amount of data for training
D. It is not a accurate as other types of models

ANSWER: A. It can be computationally expensive to train

7. Which of the following is a common application of wiener models?

A. Stock price prediction
B. Object recognition
C. Speech recognition
D. Climate modelling

ANSWER: C. Speech recognition

8. What is the purpose of the linear filter in a wiener model?

A. To remove noise from the input signal
B. To create a feedback loop in a system
C. To increase the complexity of the model
D. To produce an estimate of a desired or target random process

ANSWER: D. To produce an estimate of a desired or target random process

9. What is the name of the method used to estimate the complexity of the linear filter in a wiener model?

A. Least squares
B. Maximum likelihood
C. Gradient descent
D. Fourier transform

ANSWER: A. Least squares

10. Which of the following is a potential limitation of using a wiener model for system identification?

A. The model may be sensitive to the initial conditions
B. The model may not be able to handle nonlinearities in the system
C. The model may require too much data to train effectively
D. The model may not be able to handle time-varying systems

ANSWER: D. The model may be able to handle time-varying systems

UNIT - 3 EQUIVALENT CIRCUIT MODEL

3.1 HODGKIN HUXLEY MODEL

THIRUPURASUNDARI E
211241101049

1. The iconic current I_{ion} is subdivided into_____distinct components.

A. 2
B. 1
C. 3
D. 6

ANSWER: C. 3

2. The capacitance current I_c is defined by the rate of change of charge q at membrane surface _____

A. $I_C = dq/dt$
B. $I_C = Cm\ dVm/dt$
C. $q = CmVm$
D. $C_m\ d\ V/dt + I_{ion} = I_{ext}$

ANSWER: A. $I_C = dq/dt$

3. Some neural stimulation software packages such as_____use the opposite sign convention.

A. SWISS
B. GENESIS
C. MATLAB
D. Basware

ANSWER: B. GENESIS

4. By using the sort of fitting procedure, Hodgkin and Huxley determined the reasonable fit to the_____conductance.

A. Ca^-
B. Cl^-
C. Na^+
D. K^+

ANSWER: D. K+

5. Most axons in the squid nervous system and other nervous system are typically atleast _____times thinner.

A. 100
B. 80
C. 95
D. 118

ANSWER: A. 100

6. The electrical properties of the neuron are represented in terms of an _____

A. Electrical device
B. Capacitors
C. Electrical Equivalent Circuit
D. None of them

ANSWER: C. Electrical Equivalent circuit

7. Hodgkin and Huxley postulated that_____and_____were voltage dependent quantities.

A. G_{Na} and G_K
B. G_L
C. G_C and G_{Cl}
D. G_H and G_{Cl}

ANSWER: A. G_{Na} and G_K

8. The standard technique for accomplishing the system theory is called _____

A. Alpha Function
B. State variable representation
C. State Equation
D. Beta Function

ANSWER: B. State variable representation

9. Raising the membrane potential towards zero volts is called _____

A. Transient channels
B. Persistent channels
C. Polarization
D. Depolarization

ANSWER: D. Depolarization

10. The probability of gate being in the open state is governed by first order _____

A. Rate constant
B. Kinetic Theory
C. Rate equation
D. Dynamical system

ANSWER: C. Rate equation

3.2 RESISTIVITY AND CAPACITIVE PROPERTIES OF CELL MEMBRANE

GAYATHRI.S
211241101012

1. Which of the following best describes the electrical resistivity of the cell membrane?

   A. The cell membrane is a perfect conductor of electricity.
   B. The cell membrane is an insulator with infinite resistance.
   C. The cell membrane has a finite electrical resistance.
   D. The electrical resistivity of the cell membrane depends on the type of cell.

ANSWER: C. The cell membrane has a finite electrical resistance.

2. What is the typical resistance of the cell membrane?

   A. A few ohms
   B. A few megaohms
   C. A few kiloohms
   D. A few microohms

ANSWER: B. A few megaohms

3. What is the main factor that determines the electrical capacitance of the cell membrane?

   A. The thickness of the membrane
   B. The concentration of ions in the membrane
   C. The presence of ion channels
   D. The lipid composition of the membrane

ANSWER: D. The lipid composition of the membrane

4. What is the typical capacitance of the cell membrane?

   A. A few farads
   B. A few picofarads
   C. A few nanofarads
   D. A few millifarads

ANSWER: B. A few picofarads

5. How does the capacitance of the cell membrane affect its ability to transmit electrical signals?

   A. A higher capacitance results in a slower transmission of electrical signals.
   B. A higher capacitance results in a faster transmission of electrical signals.
   C. The capacitance of the cell membrane has no effect on the transmission of electrical signals.
   D. The effect of capacitance on signal transmission depends on the type of cell.

ANSWER: A. A higher capacitance results in a slower transmission of electrical signals

6.When a current is injected into a neuron, which of the following is true about the resulting electrical response of the cell membrane?

A. The membrane potential becomes more positive.
B. The membrane potential becomes more negative.
C. The membrane potential does not change.
D. The membrane potential becomes more variable.

ANSWER: D. The membrane potential becomes more variable.

7. Which of the following is true about the electrical response of the cell membrane to injected current?

A. The amplitude of the response increases with the duration of the injected current.
B. The amplitude of the response decreases with the duration of the injected current.
C. The amplitude of the response is not affected by the duration of the injected current.
D. The amplitude of the response is only affected by the strength of the injected current.

ANSWER: A. The amplitude of the response increases with the duration of the injected current.

8. Which of the following is true about the threshold for action potential initiation in a neuron?

A. It is a fixed value that does not change.
B. It is higher when the neuron is hyperpolarized.
C. It is lower when the neuron is depolarized.
D. It is higher when the neuron is depolarized.

ANSWER: C. It is lower when the neuron is depolarized.

9. Which of the following is true about the refractory period of a neuron?

A. It is the time during which the neuron cannot generate another action potential.
B. It is the time during which the neuron is more sensitive to injected current.
C. It is the time during which the neuron is less sensitive to injected current.
D. It is the time during which the neuron is hyperpolarized.

ANSWER: A. It is the time during which the neuron cannot generate another action potential.

10. Which of the following is true about the relationship between the strength of an injected current and the resulting membrane potential?

A. The relationship is linear.
B. The relationship is exponential.
C. The relationship is logarithmic.
D. The relationship is hyperbolic.

ANSWER: B. The relationship is exponential.

3.3 HODGKIN HUXLEY MODEL

GUNAL.N
211241101015

1. Who proposed the Hodgkin Huxley model?

   A. Andrew Huxley and Alan Hodgkin
   B. Alan Hodgkin and James Huxley
   C. Andrew Hodgkin and James Huxley
   D. None of the above

ANSWER: A. Andrew Huxley and Alan Hodgkin

2. What does the Hodgkin-Huxley model describe?

   A. The action potential of neurons
   B. The resting membrane potential of neurons
   C. The synaptic transmission of neurons
   D. The propagation of axons in the nervous system

ANSWER: A. The action potential of neurons

3. What are the main ions involved in the Hodgkin-Huxley model?

   A. Sodium and potassium
   B. Chloride and potassium
   C. Sodium and calcium
   D. Calcium and potassium

ANSWER: A. Sodium and potassium

4. Which ion is responsible for the depolarization phase of the action potential?

   A. Sodium
   B. Potassium
   C. Calcium
   D. Chloride

ANSWER: A. Sodium

5. Which ion is responsible for the depolarization phase of the action potential?

   A. Sodium
   B. Potassium
   C. Calcium
   D. Chloride

ANSWER: B. Potassium

6. What is the threshold potential in the Hodgkin-Huxley model?

   A. -70mV
   B. -55mV
   C. -40mV
   D. 0mV

ANSWER: B. -55mv

7. What is the refractory period in the Hodgkin Huxley model?

A. The period during which the membrane potential is below the resting potential
B. The period during which the membrane potential is above the resting potential
C. The period during which the neuron cannot fire another action potential
D. The period during which the neuron is hyperpolarized

ANSWER: C. The period during which the neuron cannot fire another action potential

8. What is the role of the sodium potassium pump in the Hodgkin Huxley model?

A. To maintain the resting membrane potential
B. To repolarize the neuron after an action potential
C. To hyperpolarize the neuron after an action potential
D. To remove excess calcium ions from the neuron

ANSWER: A. To maintain the resting membrane potential

9. What was the role of the myelin sheath in the propagation of action potentials?

A. To increase the speed of conduction
B. To decrease the speed of conduction
C. To prevent action potentials from occurring
D. To increase the threshold potential

ANSWER: A. To increase the speed of conduction

10. Which of the following is not a limitation of the Hodgkin Huxley model?

A. It is very complex model
B. It requires a lot of computational power
C. It cannot explain all aspects of neuronal activity
D. It is not applicable to all types of neurons

ANSWER: D. It is not applicable to all types of neurons

3.4 HODGKIN HUXLEY MODEL

JANARDHANAN D
211241101019

1. The equation gNa= 1/RNa describes:

   A. Sodium membrane conductance
   B. Sodium membrane potential
   C. Sodium membrane capacitance
   D. Sodium membrane current

ANSWER: A. Sodium membrane conductance

2. Membrane conductance for Na^+ and K^+ ions is not constant. It depends on:

   A. The state of the current-gated ion channels
   B. The state of the resistance ion channels
   C. The state of the voltage-gated ion channels
   D. None of the above

ANSWER: C. The state of the voltage-gated ion channels

3. The depolarization phase of the axonal action potential is contributed to the:

   A. Inward Na^+ current due to the activation of voltage-gated sodium channels
   B. Inward K^+ current due to the activation of voltage-gated sodium channels
   C. Outward Na^+ current due to the activation of current-gated sodium channels
   D. Outward K^+ current due to the activation of current-gated sodium channels

ANSWER: A. Inward Na^+ current due to the activation of voltage-gated sodium channels

4. The repolarization phase of the axonal action potential is contributed to

   A. The outward Na^+ current due to the activation of voltage-gated potassium channels
   B. The outward K^+ current due to the activation of voltage-gated potassium channels
   C. The inward Na^+ current due to the activation of current-gated potassium channels
   D. The inward K^+ current due to the activation of current-gated potassium channels

ANSWER: B. The outward K^+ current due to the activation of voltage-gated potassium channels

5. What happens when the membrane potential in neurons becomes equal or greater than the critical depolarisation threshold?

   A. Voltage-gated Na^+ channels open and action potential is initiated
   B. Current- gated Na^+ channels open and action potential is initiated
   C. Voltage-gated K^+ channels open and action potential is initiated
   D. Current-gated K^+ channels open and action potential is initiated

ANSWER: A. Voltage-gated Na^+ channels open and action potential is initiated

6. What kind of ion current flows across the axonal membrane during the repolarization phase of the action potential?

A. Positive K^+ current
B. Negative K^+ current
C. Positive Na^+ current
D. Negative Na^+ current

ANSWER: A. Positive K^+ current

7. During the voltage clamp method, the voltage across the membrane is fixed and the current passing through the membrane is measured:

A. Directly, by the input current required to keep the voltage fixed
B. Indirectly, by the input current required to keep the voltage fixed
C. Indirectly, by the input voltage required to keep the current fixed
D. Directly, by the input voltage required to keep the current fixed

ANSWER: B. Indirectly, by the input current required to keep the voltage fixed

8. During the resting state of the axonal membrane the ratio of the ion permeabilities for potassium and sodium is PK : PNa = 1 : 0.04. During the depolarization phase of the action potential this ratio changes as follows:

A. PK : PNa = 1:30
B. PK : PNa = 1:16
C. PK : PNa = 1:25
D. PK : PNa = 1:20

ANSWER: D. PK : PNa = 1:20

common property of " excitable" cells are:

A. The current-gated ion channels of the cellular membrane
B. The voltage-gated ion channels of the cellular membrane
C. The voltage-gated ion channels of the external membrane
D. The current-gated ion channels of the external membrane

ANSWER: B. The voltage-gated ion channels of the cellular membrane

10. What type of ion current does not pass through membrane treated with 10-5 M of TEA (tetraethylammonium) ?

A. Na^+ Influx
B. Na^+ Efflux
C. K^+ Efflux
D. K^+ Influx

ANSWER: C. K^+ Efflux

3.5 MODELLING OF EMG

MELVIN SILVESTER L
211241101028

1. What does EMG stand for?
   A. Electromyography
   B. Electromagnetic Generator
   C. Electromagnetic Grid
   D. Electromechanical Gearbox

ANSWER: A. Electromyography

2. What is EMG used for?
   A. Measuring electrical activity of the heart
   B. Measuring electrical activity of the brain
   C. Measuring electrical activity of the muscles
   D. Measuring electrical activity of the lungs

ANSWER: C. Measuring electrical activity of the muscles

3. What is the basic principle of EMG?
   A. Measurement of muscle contraction force
   B. Measurement of muscle temperature
   C. Measurement of muscle electrical activity
   D. Measurement of muscle blood flow

ANSWER: D. Measurement of muscle electrical activity

4. What is an electrode in EMG?
   A. A device that measures muscle temperature
   B. A device that measures muscle force
   C. A device that records muscle electrical activity
   D. A device that measures muscle blood flow

ANSWER: C. A device that records muscle electrical activity

5. What is surface EMG?
   A. Recording the electrical activity of deep muscles
   B. Recording the electrical activity of superficial muscles
   C. Recording the electrical activity of both deep and superficial muscles
   D. Recording the electrical activity of non-muscular tissues

ANSWER: D. Recording the electrical activity of superficial muscles

6. What is needle EMG?
   A. Recording the electrical activity of deep muscles using a needle electrode
   B. Recording the electrical activity of superficial muscles using a needle electrode
   C. Recording the electrical activity of both deep and superficial muscles using a needle electrode
   D. Recording the electrical activity of non-muscular tissues using a needle electrode

ANSWER: A. Recording the electrical activity of deep muscles using a needle electrode

7. What is the difference between surface EMG and needle EMG?
   A. Surface EMG is non-invasive, while needle EMG is invasive
   B. Surface EMG records the electrical activity of superficial muscles, while needle EMG records the electrical activity of deep muscles
   C. Surface EMG is less accurate than needle EMG
   D. There is no difference between surface EMG and needle EMG

ANSWER: A. Surface EMG is non-invasive, while needle EMG is invasive

8. What is motor unit recruitment in EMG?
   A. The number of muscle fibers that are innervated by a single motor neuron
   B. The rate at which motor neurons fire action potentials
   C. The time it takes for a muscle to contract in response to a stimulus
   D. The amount of force generated by a muscle during contraction

ANSWER: A. The number of muscle fibers that are innervated by a single motor neuron

9. What is the amplitude of an EMG signal?
   A. The duration of a muscle contraction
   B. The frequency of a muscle contraction
   C. The strength of the electrical activity recorded by the electrode
   D. The time it takes for a muscle to relax after contraction

ANSWER: C. The strength of the electrical activity recorded by the electrode

10. What is EMG biofeedback?
   A. Using EMG to train and control muscle activity
   B. Using EMG to diagnose muscle diseases
   C. Using EMG to measure muscle fatigue
   D. Using EMG to measure muscle strength

ANSWER: A. Using EMG to train and control muscle activity

3.6 ELECTRICAL RESPONSE OF THE CELL MEMBRANE

DHARSHINI.M
211241101010

1. What is the electrical response of the cell membrane to injected current?

   A. Depolarization
   B. Repolarization
   C. Hyperpolarization
   D. All of the above

   ANSWER: D. All of the above

2. What is the mechanism of depolarization of the cell membrane?

   A. Influx of sodium ions
   B. Outflux of potassium ions
   C. Influx of chloride ions
   D. Outflux of calcium ions

   ANSWER: A. Influx of sodium ions

3. What is the mechanism of repolarization of the cell membrane?

   A. Influx of sodium ions
   B. Outflux of potassium ions
   C. Influx of chloride ions
   D. Outflux of calcium ions

   ANSWER: B. Outflux of potassium ions

4. What is the mechanism of hyperpolarization of the cell membrane?

   A. Influx of sodium ions
   B. Outflux of potassium ions
   C. Influx of chloride ions
   D. Outflux of calcium ions

   ANSWER: C. Influx of chloride ions

5. What is the threshold potential for depolarization of the cell membrane?

   A. -90 mV
   B. -70 mV
   C. -50 mV
   D. 0 mV

   ANSWER: B. -70 mV

6. What is the resting membrane potential of a typical neuron?

   A. -90 mV
   B. -70 mV
   C. -50 mV
   D. 0 mV

   ANSWER: B. -70 mV

7. What is the name of the ion channel that is responsible for the depolarization phase of an action potential?

A. Sodium-potassium pump
B. Calcium channel
C. Sodium channel
D. Potassium channel

ANSWER: C. Sodium channel

8. What is the name of the ion channel that is responsible for the repolarization phase of an action potential?

A. Sodium-potassium pump
B. Calcium channel
C. Sodium channel
D. Potassium channel

ANSWER: D. Potassium channel

9. What is the typical shape of a current injection electrode used in cylindrical cells?

A. Disc
B. Cylindrical
C. Rectangular
D. Triangular

ANSWER: A. Disc

10. What is the name of the current that flows circumferentially in a cylindrical cell in response to a current injection?

A. Axial current
B. Radial current
C. Tangential current
D. Transverse current

ANSWER: C. Tangential current

3.7 ELECTRICAL RESPONSE TOINJECTED CURRENT

SELIN CHRISTY. M
211241101040

1. What is the typical resting membrane potential of a mammalian neuron?

A. -40 mV
B. -70 mV
C. -90 mV
D. -110 mV

ANSWER: B. -70 mV

2. What is the threshold potential for an action potential to occur in a mammalian neuron?

A. -40 mV
B. -55 mV
C. -70 mV
D. -90 mV

ANSWER: B. -55 mV

3. Which ion is primarily responsible for depolarization during an action potential?

A. Sodium (Na+)
B. Potassium (K+)
C. Chloride (Cl-)
D. Calcium (Ca2+)

ANSWER: A. Sodium (Na+)

4. During the falling phase of an action potential, which ion channels are primarily responsible for the repolarization of the membrane potential?

A. Sodium (Na+) channels
B. Potassium (K+) channels
C. Chloride (Cl-) channels
D. Calcium (Ca2+) channels

ANSWER: B. Potassium (K+) channels

5. Which of the following factors does not affect the speed of conduction of an action potential?

A. Axon diameter
B. Myelination
C. Resting membrane potential
D. Temperature

ANSWER: C. Resting membrane potential

6.Which type of ion channel is responsible for the generation of graded potentials?

A. Voltage-gated ion channels
B. Ligand-gated ion channels
C. Leak channels
D. All of the above

ANSWER: B. Ligand-gated ion channels

7. Which of the following is not a typical property of graded potentials?

A. They are initiated by a stimulus.
B. They can be depolarizing or hyperpolarizing.
C. They are all-or-none.
D. They can summate.

ANSWER: C. They are all-or-none.

8. What is the name of the process by which action potentials jump from one node of Ranvier to the next in myelinated axons?

A. Saltatory conduction
B. Continuous conduction
C. Passive conduction
D. Repetitive firing

ANSWER: A. Saltatory conduction

9.Which type of synapse is typically faster: electrical or chemical?

A. Electrical
B. Chemical
C. They are roughly the same speed.
D. It depends on the specific synapse.

ANSWER: A. Electrical

10. What is the name of the ion transporter that helps to restore the resting membrane potential after an action potential?

A. Sodium-potassium pump
B. Calcium pump
C. Chloride pump
D. Potassium-sodium pump

ANSWER: A. Sodium-potassium pump

3.8 AMPLITUDE MEASUREMENTS

SELVA R
211241101041

1.The response to current injection in a cylindrical cell depends on:

A. The conductivity of the cell membrane
B. The resistivity of the cell membrane
C. The size of the cell
D. All of the above

ANSWER: D. All of the above

2.What is the response to current injection in a cylindrical cell?

A. The current is evenly distributed throughout the cell.
B. The current density is highest at the centre of the cell.
C. The current density is highest at the edge of the cell.
D. The current density is highest at both the centre and the edge of the cell.

ANSWER: B. The current density is highest at the centre of the cell.

3.What is the response to current injection in a cylindrical cell?

A. The current spreads uniformly throughout the cell
B. The current only flows along the axis of the cell
C. The current flows radially outwards from the axis of the cell
D. The current flows in a spiral pattern

ANSWER: C. The current flows radially outwards from the axis of the cell.

4.What is the response to current injection in a cylindrical cell?

A. The membrane potential changes linearly with time
B. The membrane potential changes exponentially with time
C. The membrane potential remains constant
D. The membrane potential changes in a step-like manner

ANSWER: D. The membrane potential changes in a step-like manner.

5.What is the response to a current injection in a cylindrical cell?

A. The potential decays exponentially with time
B. The potential increases linearly with time
C. The potential increases exponentially with time
D. The potential remains constant

ANSWER: C. The potential increases exponentially with time.

6.What is the time constant for the response to a current injection in a cylindrical cell?

A. The time it takes for the potential to decay to 1/e of its initial value
B. The time it takes for the potential to reach its maximum value
C. The time it takes for the potential to reach half of its maximum value
D. The time it takes for the potential to remain constant

ANSWER: A. The time it takes for the potential to decay to 1/e of its initial value.

7.What is the response to current injection in a cylindrical cell?

A. There is no response.
B. The cell depolarizes.
C. The cell hyperpolarizes.
D. The response depends on the location of the current injection.

ANSWER: D. The response depends on the location of the current injection.

8. What is the current response in a cylindrical cell to a step current injection?

A. Exponential rise
B. Exponential decay
C. Linear rise
D. Linear decay

ANSWER: A. Exponential rise

9.What is the time constant for the current response in a cylindrical cell?

A. Membrane capacitance / membrane resistance
B. Membrane resistance / membrane capacitance
C. Axial resistance / membrane capacitance
D. Membrane capacitance / axial resistance

ANSWER: A. Membrane capacitance / membrane resistance

10. What is the relationship between the time constant and the speed of action potential propagation in a cylindrical cell?

A. There is no relationship
B. Cells with longer time constants have faster propagation
C. Cells with shorter time constants have faster propagation
D. The relationship is dependent on other factors and cannot be determined from time constant alone

ANSWER: C. Cells with shorter time constants have faster propagation.

3.9 HODGKIN HUXLEY MODEL

SATHISHKUMAR J
211241101039

1.Which of the following currents is responsible for the depolarization phase of the axonal action potential?

A. Inward sodium ion current
B. Inward potassium ion current
C. Outward sodium ion current
D. Outward potassium ion current

ANSWER: A. Inward sodium ion current

2.Which of the following currents is responsible for the repolarization phase of the axonal action potential?

A. Inward sodium ion current
B. Inward potassium ion current
C. Outward sodium ion current
D. Outward potassium ion current

ANSWER: D. Outward potassium ion current

3.Choose the correct statement:

A. Action potentials propagate with attenuation of amplitude and with relatives constant speed
B. Action potentials propagate with attenuation of amplitude and without relatives constant speed
C. Action potentials propagate without attenuation of amplitude and with relatives constant speed
D. Action potentials propagate without attenuation of amplitude and without relatives constant speed

ANSWER: C. Action potentials propagate without attenuation of amplitude and with relatives constant speed

4.Which of the following factors affects the speed of propagation of axonal action potentials?

A. Diameter and myelination
B. Speed and diameter
C. Distance and myelination
D. Force and speed

ANSWER: A. Diameter and myelination

5.Sodium equilibrium potential (Ena^{+}) for typical neurons is about:

A. +65mV
B. +30mV
C. +45mV
D. +70mV

ANSWER: C.+45Mv

6. The depolarization phase in typical neurons is due to :

A. K^+ ions
B. Na^+ ions
C. K^- ions
D. Na^- ions

ANSWER: B. Na^+ ions

7. The equilibrium potential of which of the following ions is the closest to the membrane resting potential?

A. Cl^+

B. Na^+

C. K^+

D. H^+

ANSWER:C.K^+

8. Treatment of tissue with tetrodotoxin(TTX) will result in

A. Inhibition of passive sodium transport
B. Inhibition of passive potassium transport
C. Stimulation of passive sodium transport
D. Stimulation of passive potassium transport

ANSWER: A. Inhibition of passive sodium transport

9. What makes the membrane resting potential so close to the potassium equilibrium potential?

A. Leak potassium channels and high membrane permeability for other ions
B. Leak sodium channels
C. Leak potassium channels and low membrane permeability for other ions
D. Leak calcium channels

ANSWER: C. Leak potassium channels and low membrane permeability for other ions

10. For experimental model Hodgkin and Huxley used the method of the:

A. Fixed Current
B. Fixed Voltage
C. Fixed Potential difference
D. All the above

ANSWER: A Fixed voltage

3.10 HODGKIN HUXLEY MODEL

SRIVARDHINI R S
211241101045

1. Hodgkin-Huxley model was performed by ion _____

A. Sodium
B. Potassium
C. Carbon
D. Both A and B

ANSWER: D. Both A and B

2. The diagonal arrow across the diagram of the resistor indicates that the value of the resistance is _____

A. Not fixed
B. Fixed
C. Partially fixed
D. Diagonally fixed

ANSWER: A. Not fixed

3. The sum of the ionic currents which pass through the cell membrane _____

A. C du/dt
B. $I_L = g_L(u-E_L)$
C. $\sum K\ I_K$
D. None of them.

ANSWER: C. $\sum K\ I_K$

4. Based on a series of voltage clamp experiments, they developed a detailed mathematical model of_____and _____

A. Polarization, Depolarization
B. Voltage dependent, Time dependent
C. Intracellular, Extracellular
D. All the above

ANSWER: B. Voltage dependent, Time dependent.

5. The batteries are used to represent the _____

A. Instantaneous membrane
B. Conductance valve
C. Capacitive Current
D. Electrochemical Potentials

ANSWER: D. Electrochemical Potentials

6. In Neural modelling ionic current flowing out of the cell is _____

A. Neutral
B. High
C. Positive
D. Low

ANSWER: C. Positive

7. Hodgkin and Huxley postulated that G_{NA} and G_K were:

A. Current dependent
B. Voltage dependent quantities
C. Properties of individual membrane
D. Instantaneous charge

ANSWER: B. Voltage dependent Quantities

8. The resting intracellular potential would be around _____

A. -70mV
B. 80mV
C. 90mV
D. <65mV

ANSWER: A. -70mV

9. Voltage clamp experiments yield estimates of n /t only at_____

A. Discrete clamp
B. Continuous function
C. Voltage clamp
D. Empirical clamp

ANSWER: A. Discrete Clamp

10. In this model, the rate constant is not really constant, but depends on_____

A. Capacitive current
B. Membrane Voltage V_M
C. I_K
D. $V_M C_M$

ANSWER: B. Membrane Voltage V_M

3.11 CIRCUIT MODEL

SUPRAJHAA.M
211241101046

1.What is an equivalent circuit model?

A. A model used to simplify complex circuits into a more manageable form
B. A model used to create complex circuits from simpler components
C. A model used to simulate the behavior of circuits in a virtual environment
D. None of these

ANSWER: A. A model used to simplify complex circuits into a more manageable form

2.Which of the following is NOT a component commonly found in an equivalent circuit model?

A. Capacitor
B. Transistor
C. Resistor
D. Switch

ANSWER: D. Switch

3.What is the purpose of an equivalent resistance in a circuit?

A. To measure the amount of current flowing through the circuit
B. To measure the amount of voltage drop across the circuit
C. To simplify a complex circuit into a single resistance value
D. Both A & B

ANSWER: C. To simplify a complex circuit into a single resistance value

4.Which of the following is a valid method for calculating the equivalent resistance of a series circuit?

A. Add the individual resistance values
B. Divide the individual resistance values
C. Multiply the individual resistance values
D. Both A & B

ANSWER: A. Add the individual resistance values

5.Which of the following is a valid method for calculating the equivalent resistance of a parallel circuit?

A. Add the individual resistance values
B. Divide the individual resistance values
C. Subtract the individual resistance values
D. Multiply the individual resistance values

ANSWER: B. Divide the individual resistance values

6. What is the purpose of an equivalent circuit model in circuit design?

A. To accurately predict the behavior of a circuit before it is built
B. To simplify a complex circuit into a more manageable form
C. To ensure that a circuit is working properly after it is built
D. To get the correct output from complex input

ANSWER: A. To accurately predict the behavior of a circuit before it is built.

7. Which of the following is an example of a complex circuit that could be simplified using an equivalent circuit model?

A. A simple flashlight circuit with a battery, switch, and light bulb
B. A complex computer circuit with multiple processors and memory banks
C. A power distribution network with multiple transformers and transmission lines
D. A transformer with secondary coil thicker and longer

ANSWER: C. A power distribution network with multiple transformers and transmission lines

8. Which of the following is an advantage of using an equivalent circuit model?

A. It allows for more precise control over the behavior of a circuit
B. It can help identify potential issues with a circuit before it is built
C. It makes it easier to troubleshoot issues with a circuit after it is built
D. It helps to arrange the circuit without any damage

ANSWER: B. It can help identify potential issues with a circuit before it is built

9. Which of the following is an example of a circuit element that can be modeled using an equivalent circuit model?

A. An electric motor
B. A lightning bolt
C. A radio wave
D. An ultraviolet wave

ANSWER: A. An electric motor

10. What is the primary benefit of using an equivalent circuit model in circuit analysis?

A. It allows for a more detailed analysis of the behavior of a circuit
B. It simplifies a complex circuit into a more manageable form for analysis
C. It provides a more accurate representation of the behavior of a circuit in the real world
D. It provides efficient access to manage the circuits

ANSWER: B. It simplifies a complex circuit into a more manageable form for analysis

UNIT - 4 PHYSIOLOGICAL MODELING – I

4.1 MODEL OF HENLES LOOP

ABISHEKKANNAN M
211241101001

1.The part of nephron involved in active reabsorption of sodium is_____

A. Distal convoluted tubule
B. Proximal convoluted tubule
C. Bowman's capsule
D. Descending limb of Henle's loop

ANSWER: B. Proximal convoluted tubule

2.What is the function of the loop of Henle in the nephron?

A. Filteration of blood
B. Secretion of waste products
C. Reabsorption of water and ions
D. Product of urine

ANSWER: C. Reabsorption of water and ions

3.How many limbs does the loop of Henle have?

A. 1
B. 2
C. 3
D. 4

ANSWER: B.2

4.What is the descending limb of the loop of Henle permeable to?

A. Water
B. Sodium ions
C. Chloride ions
D. All of the above

ANSWER: A. Water

5.What is the ascending limb of the loop of Henle impermeable to?

A. Water
B. Chloride ions
C. Sodium ions
D. All of the above

ANSWER: A. Water

6. What is the thick ascending limb of the loop of henle responsible for reabsorbing?

A. Sodium ions
B. Chloride ions
C. Potassium ions
D. All of the above

ANSWER: D. All of the above

7. Which part of the loop of Henle is responsible for creating a concenteration gradient in the renal medulla?

A. Descending limb
B. Ascending limb
C. Thin segment
D. Collecting duct

ANSWER: B. Ascending limb

8. What is the counter current mechanism in the loop of henle?

A. The flow of filterate in opposite directions in the descending and ascending limbs
B. The exchange of ions between the filterate and the interstitial fluid
C. The movement of water through the aquaporins in the thin segment
D. The regulation of blood pressure by the juxtaglomerulus apparatus

ANSWER: A. The flow of filterate in opposite directions in the descending and ascending limbs

9. Which hormone regulates the reabsorption of sodium ions in the loop of henle?

A. Aldosterone
B. Antidiuretic hormone
C. Atrial natriuretic peptide
D. Renin

ANSWER: A. Aldosterone

10. Which disease is associated with a malfunction of the loop of henle?

A. Hypertension
B. Nephrotic syndrome
C. Bartter syndrome
D. Diabetes inspidus

ANSWER: C. Bartter syndrome

4.2 COUNTER CURRENT MODEL OF URINE FORMATION

DEVADHARSHINI V
211241101009

1.What is the primary function of the counter mechanism in urine formation?

A. To create a concentration gradient that allow for reabsorption of water and solutes
B. To increase the volume of urine produced by the kidneys
C. To regulate the PH of the urine
D. To remove waste products from the bloodstream

ANSWER: A. To create a concentration gradient that allow for reabsorption of water and solutes

2.Where is the kidney does the counter current mechanism occur?

A. Bowman's capsule
B. Glomerulus
C. Proximal convoluted tubule
D. Loop of Henle

ANSWER: D. Loop of Henle

3.The descending limb of the loop of Henle is permeable to:

A. Water
B. Sodium
C. Chloride
D. Potassium

ANSWER: A. Water

4The ascending limb of the loop of Henle is impermeable to:

A. Water
B. Sodium
C. Chloride
D. Potassium

ANSWER: A. Water

5.Which of the following hormones is responsible for regulating the counter current mechanism?

A. Antidiuretic hormone(ADH)
B. Aldosterone
C. Atrial natriuretic peptide (ANP)
D. Parathyroid hormone (PTH)

ANSWER: A. Antidiuretic hormone (ADH)

6.Which of the following is not a function of the Henle in the counter current mechanism?

A. Reabsorption of water and solutes
B. Concentration of urine

C. Generation of a concentration gradient
D. Regulation of blood pressure

ANSWER: D. Regulation of blood pressure

7. The vasa recta is a network of:

A. Capillaries
B. Arteries
C. Veins
D. Lymph vessels

ANSWER: A. Capillaries

8. Which of the following is true regarding the flow of blood in the vasa recta?

A. Blood flows in the opposite direction to the flow of filterate in the loop of Henle
B. Blood flows in the same direction as the flow of filterate in the loop of Henle
C. Blood flows from the distal convoluted tubule to the proximal convoluted tubule
D. Blood flows from the Bowmans capsule to the glomerulus

ANSWER: A. Blood flows in the opposite direction to the flow of filterate in the loop of Henle

9. The concentration of urine produced by the kidneys is influenced by:

A. The amount of the water consumed by an individual
B. The concentration of solute in the blood
C. The presence of antidiuretic hormone(ADH)
D. All of the above

ANSWER: D. All of the above

10. In what part of the nephrones does not reabsorption of sodium ions occur in the counter current mechanisms?

A. Bowmans capsule
B. Glomerulus
C. Proximal convoluted tubule
D. Loop of Henle

ANSWER: D. Loop of Henle

4.3 GERM AND PLASMA CELL

RIDHA FATHIMA. M
211241101037

1. What is a germ cell?

   A. A type of immune cell that produces antibodies
   B. A type of cell that gives rise to gametes
   C. A type of stem cell found in bone marrow
   D. A type of cell that lines the respiratory tract

ANSWER: B. A type of cell that gives rise to gametes

2. Where are germ cells found?

   A. In the gonads
   B. In the bone marrow
   C. In the thymus gland
   D. In the spleen

ANSWER: A. In the gonads.

3. What is a plasma cell?

   A. A type of immune cell that produces antibodies
   B. A type of stem cell found in bone marrow
   C. A type of cell that lines the respiratory tract
   D. A type of cell that gives rise to gametes

ANSWER: A. A type of immune cell that produces antibodies

4. What is the function of a plasma cell?

   A. To produce antibodies that can recognize and neutralize pathogens
   B. To produce cytokines that regulates immune responses
   C. To present antigens to other immune cells
   D. To engulf and destroy foreign particles

ANSWER: A. To produce antibodies that can recognize and neutralize pathogens

5. What type of immunity do plasma cells contribute to?

   A. Innate immunity
   B. Adaptive immunity
   C. Both innate and adaptive immunity
   D. None of the above

ANSWER: B. Adaptive immunity

6. What is the precursor of a plasma cell?

A. B Lymphocyte
B. T Lymphocyte
C. Natural Killer cell
D. Macrophage

ANSWER: B. T Lymphocyte

7. What is the process by which a B lymphocyte becomes a plasma cell?

A. Antigen presentation
B. Cytokine secretion
C. T cell activation
D. Differentiation

ANSWER: D. Differentiation

8. What is the role of the endoplasmic reticulum in the production of antibodies by plasma cells?

A. To transport and modify newly synthesized proteins
B. To engulf and destroy foreign practices
C. To present antigens to other immune cells
D. To regulate the production of cytokines

ANSWER: A. To transport and modify newly synthesized proteins

9. What is the function of the Golgi apparatus in the production of antibodies by plasma cells?

A. To package and sort newly synthesized proteins
B. To engulf and destroy foreign particles
C. To regulate the production of cytokines
D. To regulate the production of cytokines

ANSWER: A. To package and sort newly synthesized proteins

10. What is the difference between a memory B cell and a plasma cell?

A. Memory B cells produce cytokines, while plasma cells produce antibodies
B. Plasma cells produce cytokines, while memory B cells produce antibodies
C. Memory B cells are long-lived and can mount a faster and stronger immune response upon re-exposure to an antigen, while plasma cells have a shorter lifespan
D. Plasma cells are live-lived and mount a faster and stronger immune response upon re-exposure to an antigen, while memory B cells have a shorter lifespan

ANSWER: C. Memory B cells are long-lived and can mount a faster and stronger immune response upon re-exposure to an antigen, while plasma cells have a shorter lifespan

4.4 LINEARIZED MODEL OF IMMUNE RESPONSE

VINODITA.N.R
211241101055

1.Which of the following is a potential application of the linearized model of immune response?

A. Designing personalized immunotherapies for cancer
B. Developing new antibodies to treat infections disease
C. Studying the genetics of autoimmune disease
D. Optimizing the use of immunosuppressive drugs

ANSWER: A. Designing personalized immunotherapies for cancer

2.What is the role of cytokines in the linearized model of immune response?

A. To regulate the immune response and control inflammation
B. To activate T cells and promote antigen presentation
C. To neutralize pathogens and prevent their spread
D. To induce apoptosis in inflected cells

ANSWER: A. To regulate the immune response and control information

3.Which of the following is not a type of T cell in the linearized model of immune response?

A. Helper T cells
B. Cytotoxic T cells
C. Memory T cells
D. Regulatory T cells

ANSWER: C. Memory T cells

4.What is the purpose of the linearized model of immune response in vaccine development?

A. To predict the efficacy of vaccine in including an immune response
B. To determine the optimal dosage and administration schedule of a vaccine
C. To identify potential adverse effects a vaccine
D. To assess the long-term effectiveness of a vaccine

ANSWER: A. To predict the efficacy of vaccine in including an immune response

5.Which of the following is a key assumption of the linearized model of immune response?

A. Immune cells can recognize and respond to any foreign antigen
B. The immune response is always successful in eliminating pathogens
C. The immune system is capable of adapting to any new pathogen
D. The immune response is linear and proportional to the pathogen load

ANSWER: D. The immune response is linear and proportional to the pathogen load

6.What is the basic structure of the linearized model of immune response?

A. A set of ordinary differential equations
B. A set of partial differential equations
C. A set of stochastic differential equations
D. A set of algebraic equations

ANSWER: A. A set of ordinary differential equations

7.Which of the following is not a variable in the linearized model of immune response?

A. Pathogen load
B. Antibody concentration
C. Cytokine production
D. Antigen diversity

ANSWER: D. Antigen diversity

8. Which of the following is not a component of the linearized model of immune response?

A. Pathogens
B. Antibodies
C. T cells
D. Antigens

ANSWER: B. Antibodies

9.In the linearized model of immune response, Which type of cells are responsible for presenting antigens to T cells?

A. B cells
B. Macrophages
C. Dendritic cells
D. None of the above

ANSWER: C. Dendritic cells

10. In the linearized model of immune response. Which type of cells are responsible for producing antibodies?

A. T cells
B. B cells
C. Macrophages
D. None of the above

ANSWER: B. B cells

4.5 ANTIBODY

MOHAMMED AKRAM M
211241101601

1. What are antibodies?

   A. Proteins produced by T cells
   B. Proteins produced by B cells
   C. Hormones produced by the pituitary gland
   D. Enzymes produced by the pancreas

ANSWER: B. Produced by B cells

2. What is the primary function of antibodies?

   A. To fight off bacterial infections
   B. To fight off viral infections
   C. To fight off fungal infections
   D. To fight off parasitic infections

ANSWER: B. To fight off viral infections

3. Which immunoglobulin is the most abundant in human serum?

   A. IgA
   B. IgD
   C. IgE
   D. IgG

ANSWER: D. lgG

4. Which type of antibody is the first to be produced in response to an infection?

   A. IgA
   B. IgD
   C. IgM
   D. IgE

ANSWER: C. IgM

5. Which type of antibody is involved in allergic reactions?

   A. IgA
   B. IgD
   C. IgE
   D. IgG

ANSWER: C. IgE

6. Which type of antibody is found in secretions such as tears and saliva?

   A. IgA
   B. IgD

C. IgE
D. IgG

ANSWER: A. IgA

7. Which type of antibody is involved in the mucosal immune response?

A. IgA
B. IgD
C. IgE
D. IgG

ANSWER: A. IgA

8. Wht is the role of antibodies in vaccines?

A. To stimulate the production of memory B cells
B. To directly kill the pathogens
C. To activate T cells
D. To reduce inflammation

ANSWER: A. To stimulate the production of memory B cells

9. Which type of antibody is transported across the placenta to protect a fetus?

A. IgA
B. IgD
C. IgE
D. IgG

ANSWER: D. IgG

10. Which type of antibody is used in passive immunization?

A. IgA
B. IgD
C. IgE
D. IgG

ANSWER: D. IgG

4.6 ELECTRICAL ANALOG OF BLOOD VESSELS

VASUNDARAS
211241101054

1. Which electrical component is analogous to the walls of blood vessels?

   A. Resistor
   B. Capacitor
   C. Inductor
   D. Diode

ANSWER: A. Resistor

2. Which electrical component is analogous to the heart pumping blood through the blood vessels?

   A. Capacitor
   B. Transistor
   C. Inductor
   D. Voltage source

ANSWER: D. Voltage source

3. Which electrical parameter is analogous to blood pressure?

   A. Voltage
   B. Current
   C. Resistance
   D. Capacitance

ANSWER: A. Voltage

4. Which electrical parameter is analogous to blood flow rate?

   A. Voltage
   B. Current
   C. Resistance
   D. Capacitance

ANSWER: B. Current

5. Which electrical component is analogous to the valves I blood vessels that prevent backflow?

   A. Resistor
   B. Capacitor
   C. Diode
   D. Transistor

ANSWER: C. Diode

6. Which electrical component is analogous to a blood clot in a blood vessel?

A. Capacitor
B. Resistor
C. Inductor
D. Fuse

ANSWER: D. Fuse

7. Which electrical parameter is analogous to the viscosity of blood?

A. Voltage
B. Current
C. Resistance
D. Capacitance

ANSWER: C. Resistance

8. Which electrical parameter is analogous to the elasticity of blood vessels?

A. Voltage
B. Current
C. Resistance
D. Capacitance

ANSWER: D. Capacitance

9. Which electrical component is analogous to the network of blood vessels branching out from larger vessels?

A. Transistor
B. Resistor network
C. Capacitor bank
D. Inductor array

ANSWER: B. Resistor network

10. Which electrical parameter is analogous to the diameter of blood vessels?

A. Voltage
B. Current
C. Resistance
D. Capacitance

ANSWER: C. Resistance

4.7 TRANSFER SOLUTES BETWEEN PHYSIOLOGICAL COMPARTMENTS BY FLUID FLOW

RIZWANA BEGUM K
211241101038

1. The percentages of water in each of the fluid compartments are approximately ___ intracellular fluid,____interstitial fluid and_____plasma

A. 22%, 13%, 65%
B. 70%, 20%, 10%
C. 65%, 22%, 13%
D. 20%, 10%, 70%

ANSWER : C. 65%, 22%, 13%

2. Osmosis is_____.

A. the active movement of water across a permeable membrane from a region of high solute concentration to that of a lower solute concentration

B. the passive movement of water across a semi-permeable membrane from a region of high solute concentration to that of a lower solute concentration

C. the active movement of water across a permeable membrane from a region of low solute concentration to that of a higher solute concentration

D. the passive movement of water across a semi-permeable membrane from a region of low solute concentration to that of a higher solute concentration

ANSWER: D. the passive movement of water across a semi-permeable membrane from a region of low solute concentration to that of a higher solute concentration

3.The colloidal osmotic or oncotic pressure is_____

A. important for controlling cell volume
B. a key determinant for fluid movement across capillary walls
C. largely determined by the Na+ concentration in plasma
D. higher in interstitial fluid than in plasma

ANSWER: B. a key determinant for fluid movement across capillary walls

4.If a hypotonic fluid is ingested_____

A. intracellular fluid is diluted and cells swell
B. intracellular fluid is diluted but cells stay the same size
C. intracellular fluid is unaffected
D. intracellular fluid is concentrated and cells shrink

ANSWER: A. intracellular fluid is diluted and cells swell

5. Viscosity of blood increases with rise in_____
   A. albumin
   B. globulin
   C. fibrinogen
   D. prothrombin

ANSWER: A. albumin

6.Gibb's Donnan effect creates_____
   A. diffusion
   B. surface tension
   C. osmotic pressure
   D. none of the above

ANSWER: C. osmotic pressure

7.Solute contributes to the movement of water between cells and the surrounding medium by _____.

   A. Brownian movement
   B. hydrostatic pressure
   C. osmotic pressure
   D. random motion

ANSWER: C. osmotic pressure

8.Compared to the intracellular fluid, the extracellular fluid has a high concentration of:
   A. protein
   B. phosphate
   C. calcium
   D. magnesium

ANSWER: C. calcium

9. Oedema is due to low colloid osmotic pressure of plasma and is caused by:
   A. heart Failure
   B. arteriolar Dilation
   C. liver Disease
   D. venous Obstruction

ANSWER: C) liver Disease

10. The ratio of body water to body weight is highest among:
   A. average adult males
   B. obese adult males
   C. females
   D. new born children

ANSWER: D. new born children

4.8 SYSTEM EQUATION AND STABILITY CRITERIA

PRAVEEN KUMAR S
211241101034

1. What is a system equation?

   A. An equation that describes the behaviour of a physical system.
   B. An equation that is solved using a computer system.
   C. An equation that is used to calculate system error.
   D. An equation that is used to optimize system performance a computer system.

ANSWER: A. An equation that describes the behaviour of a physical system.

2. Which of the following is not a type of system equation?

   A. Differential equation.
   B. Algebraic equation.
   C. Integral equation.
   D. Trigonometric equation.

ANSWER: D. Trigonometric equation.

3. What is the order of a system equation?

   A. The degree of the polynomial in the equation.
   B. The highest power of the derivative in the equation.
   C. The number of terms in the equation.
   D. The number of unknowns in the equation.

ANSWER: B. The highest power of the derivative in the equation.

4. What is a transfer function?

   A. A function that describes the relationship between the input and output of a system
   B. A function that is used to transform one type of equation into another
   C. A function that is used to generate random numbers
   D. A function that is used to calculate the inverse of a matrix

ANSWER: A. A function that describes the relationship between the input and output of a system

5. Which of the following is not a stability criterion for linear systems?

   A. Routh-Hurwitz criterion
   B. Nyquist criterion
   C. Bode criterion
   D. Lyapunov criterion

ANSWER: D. Lyapunov criterion

6. What is the root locus method?

A. A graphical method used to determine the stability of a system
B. A method used to calculate the roots of a polynomial equation
C. A method used to calculate the transfer function of a system
D. A method used to calculate the Laplace transform of a function

ANSWER: A. A graphical method used to determine the stability of a system

7. What is the Laplace transform?

A. A mathematical technique used to solve differential equations
B. A method used to calculate the transfer function of a system
C. A method used to calculate the roots of a polynomial equation
D. A method used to transform one type of equation into another

ANSWER: A. A mathematical technique used to solve differential equations

8. What is the steady-state response of a system?

A. The response of a system after all transients have decayed
B. The response of a system during transients
C. The response of a system to a sudden input
D. The response of a system to a sinusoidal input

ANSWER: A. The response of a system after all transients have decayed

9. Which of the following is not a characteristic of a stable system?

A. All poles of the transfer function
B. The system is bounded and does not oscillate
C. The system has a finite and predictable response are in the left-half plane
D. The system is sensitive to small changes in the initial conditions

ANSWER: D. The system is sensitive to small changes in the initial conditions

10. Which of the following is not a way to achieve stability in a system?

A. Adding feedback to the system
B. Increasing the gain of the system
C. Adding damping to the system
D. Decreasing the natural frequency of the system

ANSWER: B. Increasing the gain of the system

4.9 MODEL OF CORONARY CIRCULATION

SNEKAA. M
211241101043

1.What is the primary function of the coronary circulation?

A. To supply oxygenated blood of the heart muscle
B. To remove deoxygenated blood from the heart muscle
C. To supply nutrients to the heart muscled
D. To remove waste products from the heart muscle

ANSWER: A. To supply oxygenated blood to the heart muscle

2.Which coronary artery supplies blood to the left ventricle?

A. Right coronary artery
B. Left anterior descending artery
C. Circumflex artery
D. Marginal artery

ANSWER: B. Left anterior descending artery

3.What is the name of the condition that occurs when one or more of the coronary arteries become narrowed or blocked resulting in reduced blood flow to the heart muscle?

A. Myocardial infarction
B. Coronary artery disease
C. Angina pectoris
D. Atherosclerosis

ANSWER: B. Coronary artery disease

4.Which of the following is a major risk factor for coronary artery disease?

A. High HDL cholesterol levels
B. Physical inactivity
C. Normal blood pressure
D. Eating a healthy diet

ANSWER: B. Physical inactivity

5.What is the name of the network of the small blood vessels that connect the smallest arteries and veins in the heart muscle?

A. Capillaries
B. Arteries
C. Venules
D. Anastomoses

ANSWER: D. Anastomoses

6. Which of the following can cause a temporary decrease in blood flow to the heart muscle?

A. Emotional stress.
B. Atherosclerosis
C. Coronary artery blockage
D. Myocardial infarction

ANSWER: A. Emotional stress

7. What is the name of the condition that occurs when blood flow to the heart muscle is reduced temporarily leading to chest pain?

A. Myocardial infarction
B. Coronary artery disease
C. Atherosclerosis
D. Angina pectoris

ANSWER: D. Angina pectoris

8. Which of the following is a common symptoms of myocardial infarction?

A. Shortness of breadth
B. Chest pain or discomfort
C. Nausea or vomiting
D. All of the above

ANSWER: D. All of the above

9. Which of the following imaging techniques can be used to visualise the coronary arteries?

A. X-ray
B. Magnetic resonance imaging (MRI)
C. Computed Tomography (CT)
D. Ultrasound

ANSWER: C. Computed tomography (CT)

10. What is the name of the surgical procedure used to treat severe blockages in the coronary arteries?

A. Coronary angiography
B. Coronary stenting
C. Coronary bypass surgery
D. Atherectomy

ANSWER: C. Coronary bypass surgery

4.10 MODEL OF SYSTEMATIC BLOOD FLOW

SWETHA.J
211241101048

1. Which of the following is the correct order of blood flow through the systemic circulation?

   A. Arteries veins capillaries.
   B. Capillaries arteries veins.
   C. Veins capillaries arteries.
   D. Arteries capillaries veins.

ANSWER: D. Arteries capillaries veins.

2. The largest artery in the body is the _____
   A. Aorta.
   B. Pulmonary artery.
   C. Carotid artery.
   D. Femoral artery.

ANSWER: A. Aorta

3. The smallest blood vessels in the body are the_____
   A. Arteries.
   B. Veins.
   C. Capillaries.
   D. Sinuses.

ANSWER: C. Capillaries.

4. Which of the following is not a component of blood?
   A. Red blood cells.
   B. White blood cells.
   C. Platelets.
   D. Lymphocytes.

ANSWER: D. Lymphocytes.

5. Oxygenated blood from the lungs enters the heart through the_____
   A. Superior vena cava.
   B. Inferior vena cava.
   C. Pulmonary vein.
   D. Pulmonary artery.

ANSWER: C. Pulmonary vein.

6. The left ventricle of the heart pumps blood into the_____
   A. Pulmonary artery.
   B. Aorta.
   C. Superior vena cava.
   D. Inferior vena cava.

ANSWER: B. Aorta.

7. The smallest functional unit of the lung is the_____
   A. Bronchiole.
   B. Alveolus.
   C. Bronchus.
   D. Trachea.

ANSWER: B. Alveolus.

8. The hepatic portal vein carries blood from the digestive system to the_____
   A. Kidneys.
   B. Liver.
   C. Pancreas.
   D. Spleen.

ANSWER: B. Liver.

9. Which of the following is not a type of blood vessel?
   A. Arteriole.
   B. Venule.
   C. Atrium.
   D. Capillary.

ANSWER: C. Atrium.

10. The process of blood clotting is called_____
   A. Hematopoiesis.
   B. Hemostasis.
   C. Hemolysis.
   D. Hematuria.

ANSWER: B. Hemostasis.

UNIT - 5 PHYSIOLOGICAL MODELING – II

5.1 ENGINEERING MODELLING OF HUMAN CARDIOVASCULAR SYSTEM

DEENATHAYALAN AYYAPPAN
211241101007

1. Cardiovascular system is primarily considered as_____

A. Human body's control system
B. Human body's transport system
C. Human body's maintenance system
D. Human body's metabolism

ANSWER: B. Human body's transport system

2. Construction of this model was based on the interaction between the ___ and the vascular circulation of the system

A. Nose
B. Pulsating lungs
C. Pulsating heart
D. Kidney

ANSWER: C. Pulsating heart

3.The pulsating heart provides__ for the whole circulatory system.

A. Energy
B. Power
C. Speed
D. None of them.

ANSWER: B. Power

4. The left ventricle pumps the blood to_____ area.

A. Low pressure
B. High pressure
C. Veins
D. All the above

ANSWER: B. High pressure.

5.The veins contains muscles which allow ____ of volume to the other parts of cardiovascular systems.

A. Mobilization
B. Contraction
C. Compression
D. Connection

ANSWER: A. Mobilization.

6.The blood inertia is introduced using_____

A. Atoms
B. Molecules
C. Coils
D. None of the Above

ANSWER: C. Coils.

7. The blood flow leaving the ventricle depends on _____ opening

A. The ventricle valve
B. The aortic valve
C. Both A and B
D. Capillary

ANSWER: B. The aortic valve

8. When the cardiac muscle fibers are relaxed, the ventricle fills through an_____ pressure

A. Aortic
B. Exponential
C. Ventricular
D. None of the above

ANSWER: B. Exponential.

9. The total amount of blood initially contained in the vascular system is____

A. 5,600ml
B. 5,100ml
C. 5,450ml
D. 5,300ml

ANSWER: D. 5,300ml.

10. The proposed model constitutes a generalization of the mathematical model described by Ursino in the year of_____

A. 1995
B. 1978
C. 2000
D. 1998

ANSWER: D. 1998.

5.2 EQUIVALENT CIRCUITS /MIMO SYSTEMS

JOHN ARTHUR. A
211241101022

1. Ventilatory flow rates are generally measured in_____

   A. BTPS
   B. BPM
   C. STPD
   D. mm Hg

ANSWER: A. BTPS

2. The respiratory controller consists _____

   A. Respiratory Rhythm
   B. Chemoreceptors
   C. Neuro Muscular receptors
   D. None of these

ANSWER: B. Chemoreceptors

3. Name the equivalent component for heart valves____

   A. Capacitor
   B. Diode
   C. BJT
   D. FET

ANSWER: B. Diode

4. Cardiac model consists of_____

   A. systemic Circuit
   B. cardiac model
   C. Pulmonary circuit
   D. Both (a) and (b)

ANSWER: D. Both (a) and (b)

5. Which of the following term can biologically be related to inductance?

   A. Compliance
   B. Pressure
   C. Blood flow
   D. Blood Inertia

ANSWER: D. Blood Inertia

6. Name the immunity response shown by human physiological structure

   A. Adaptive
   B. Passive
   C. Innate
   D. both (a) and (b)

ANSWER: D. Both (a) and (b)

7. Infected cells are induced to undergo apoptosis by _____

A. T Killer cells
B. Both (a) and (b)
C. Memory B cells
D. None of the above

ANSWER: A. T Killer cells

8. Which of the following is a highly desired feature for model predictive control?

A. It is ideal in determining short-term behavior.
B. It is the simplest of all feed forward controller types.
C. It accounts for system constraints.
D. Controllers of this type are universal and can be used without modification for any process.

ANSWER: C. it accounts for system constraints

9. For a MIMO control system containing 4 different manipulated and 4 different controlled variables, how many control configurations are possible for the system?

A. 24
B. 64
C. 4
D. 256

ANSWER: A. 24

10. MIMO stands for _____

A. Many inputs many output
B. Multiple input multiple output
C. Major input minor output
D. Minor input minor output

ANSWER: B. Multiple Input Multiple Output

5.3 OXYGEN GLUCOSE MONITORING

KRISHNA RAJ. R
211241101025

1. What are the two inputs in a human physiological model?

A. Oxygen and glucose
B. Food and water
C. Carbon dioxide and water
D. Blood pressure and heart rate

ANSWER: A. Oxygen and glucose

2.What is the primary function of oxygen in the human body?

A. It provides energy to the cells
B. It regulates blood pressure
C. It helps digest food
D. It lubricates joints

ANSWER: A. It provides energy to the cells

3. What is the primary function of glucose in the human body?

A. It provides energy to the cells
B. It regulates blood pressure
C. It helps digest food
D. It lubricates joints

ANSWER: A. It provides energy to the cells

4. What is the process by which oxygen and glucose are converted into energy in the body?

A. Respiration
B. Digestion
C. Circulation
D. Excretion

ANSWER: A. Respiration

5.What is the main organ responsible for respiration in the human body?

A. The heart
B. The lungs
C. The liver
D. The pancreas

ANSWER: B. The lungs

6. What is the process by which oxygen is transported to the cells in the body?

A. Respiration
B. Circulation
C. Digestion
D. Excretion

ANSWER: B. Circulation

7. What is the main organ responsible for circulation in the human body?

A. The heart
B. The lungs
C. The liver
D. The pancreas

ANSWER: A. The heart

8. What is the process by which glucose is transported to the cells in the body?

A. Respiration
B. Circulation
C. Digestion
D. Excretion

ANSWER: B. Circulation

9. What is the main organ responsible for regulating glucose levels in the body?

A. The liver
B. The pancreas
C. The kidneys
D. The spleen

ANSWER: B. The pancreas

10. What is the condition that occurs when there is too much glucose in the blood?

A. Hypoglycemia
B. Hyperglycemia
C. Hypertension
D. Hypotension

ANSWER: B. Hyperglycemia

5.4 HUMAN IMMUNE SYSTEM

KARTHICKEYAN. V
211241101024

1. Which type of cell is responsible for producing antibodies?

   A. T cells
   B. B cells
   C. Natural killer cells
   D. Macrophages

ANWER: B. B cells

2. Which type of cell is responsible for directly attacking and killing virus-infected cells?

   A. T cells
   B. B cells
   C. Natural killer cells
   D. Macrophages

ANSWER: A. T cells

3. Which type of immunity is conferred by vaccination?

   A. Innate immunity
   B. Passive immunity
   C. Acquired immunity
   D. Adaptive immunity

ANWER: C. Acquired immunity

4. Which type of immunity is present at birth and provides immediate, non-specific protection against pathogens?

   A. Innate immunity
   B. Passive immunity
   C. Acquired immunity
   D. Adaptive immunity

ANSWER: A. Innate immunity

5. Which type of immunity is provided by maternal antibodies transferred to a newborn through breast milk?

   A. Innate immunity
   B. Passive immunity
   C. Acquired immunity
   D. Adaptive immunity

ANSWER: B. Passive immunity

6. Which type of cell is responsible for engulfing and destroying pathogens?

A. T cells
B. B cells
C. Natural killer cells
D. Macrophages

ANSWER: D. Macrophages

7. Which type of cell is responsible for remembering and quickly responding to a previously encountered pathogen?

A. T cells
B. B cells
C. Memory cells
D. Macrophages

ANSWER: C. Memory cells

8. Which type of immune response involves the production of antibodies?

A. Cellular immunity
B. Humoral immunity
C. Innate immunity
D. Adaptive immunity

ANSWER: B. Humoral immunity

9. Which type of immunity involves the activation of T cells to directly attack infected cells?

A. Cellular immunity
B. Humoral immunity
C. Innate immunity
D. Adaptive immunity

ANSWER: A. Cellular immunity

10. Which type of cell is responsible for detecting and killing cancer cells?

A. T cells
B. B cells
C. Natural killer cells
D. Macrophages

ANSWER: C. Natural killer cells

5.5 SPATIOTEMPORAL MODELLING

PAUL EPHRAIM D
211241101032

1. Spatiotemporal model arise when data are collected across?

   A. Space
   B. Time
   C. Both space and time
   D. None

ANSWER: C. Both space and time

2. Other applications of spatiotemporal include

   A. Ecology
   B. Forestry
   C. Meteorology
   D. All of the above

ANSWER: D. All of the above

3. The two primary goals of spatiotemporal analysis are

   A. Analysis and description
   B. Prediction and description
   C. Description and regression
   D. Prediction and analysis

ANSWER: B. Prediction and description

4. Temporal data is often analysed as

   A. Multiple data points per observation
   B. Single detailed observation
   C. Double data extraction
   D. Both b and c

ANSWER: A. Multiple data points per observation

5. Spatial data can analyse levels such as

   A. Zip codes
   B. Census tract
   C. Geocode
   D. All of the above

ANSWER: D. All of the above

6. Which one from below is a type pf spatiotemporal study design

   A. Longitudinal design
   B. Multidivisional structure
   C. None of the above
   D. Both a and b

ANSWER: A. Longitudinal design

7.What are all the data format that is used in spatiotemporal modeling?

A. Spatial point pattern data set
B. Geo statistical data set
C. Small area data set
D. All of the above

ANSWER: D. All of the above

8.Examples of health outcomes that are modeled using spatiotemporal modeling includes

A. Zika virus
B. Cholera
C. Both A and B
D. None

ANSWER: C. Both A and B

9. In repeated cross-sectional design the researchers choose

A. Different sets of locations on each sampling occasion
B. A single location for a single sampling occasion
C. Different sets of location for randomly picked any two occasions
D. None

ANSWER: A. Different sets of locations on each sampling occasion

10. A real- time spatiotemporal-surveillance can help in

A. Target prevention
B. Target control activities
C. Make long term plans
D. All of the above

ANSWER: D. All of the above

HISTORY

Aiming to bring about change and progress through education, the Tmt. Kannammal Educational Trust was constituted in 1985 and started Thai Moogambigai Polytechnic College. Within three years of its inception, Dr. M.G.R. Engineering College was founded in 1988, and the Thai Moogambigai Dental College was started in the year 1991. Both the colleges acquired Deemed University status in 2003 as Dr. M.G.R. Educational and Research Institute as per the orders of the University Grants Commission, New Delhi and the Union Ministry of Human Resources and Development, Government of India, New Delhi.

VISION

The 21st century poses a lot of challenges that could be overcome with the help of education and technology. Keeping this in mind Dr. M.G.R Educational and Research Institute University was started with a vision of providing a better foothold for the students of today to face the challenges. To succeed in the world today you need more than just academics. The modern adult is expected to have a combination of technical know-how and ambitious confidence. Being aware of the demand that is placed on the youth today, Dr. M.G.R. Educational and Research Institute University has preserved to nurture and groom young men and women through Engineering, Medical, Dental and Humanities and Sciences.

ISBN 978-93-95054-58-4